FOURTH FIVE-YEAR REVIEW REPORT FOR
PALERMO WELL FIELD GROUND WATER CONTAMINATION SUPERFUND SITE
THURSTON COUNTY, WASHINGTON

SEPTEMBER 2018

Prepared by

U.S. Environmental Protection Agency
Region 10
Seattle, Washington

for

Sheryl Bilbrey, Director
Office of Environmental Cleanup

9/17/2018

Date

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LIST OF ABBREVIATIONS & ACRONYMS

1,1-DCE	1,1-Dichloroethene
1,2-DCA	1,2-Dichloroethane
ARAR	Applicable or Relevant and Appropriate Requirement
ASAOC	Administrative Settlement Agreement and Order on Consent for Response Actions
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
cis-1,2-DCE	*cis*-1,2-Dichlorothene
CIC	Community Involvement Coordinator
CMTL	Current Materials Testing Lab
COC	Chemical of Concern
CSM	Conceptual Site Model
DGR	Data Gap Investigation Report
Ecology	Washington State Department of Ecology
EPA	United States Environmental Protection Agency
FMTL	Former Materials Testing Lab
FS	Feasibility Study
FYR	Five-Year Review
HI	Hazard Index
HQ	Hazard Quotient
IC	Institutional Control
J	Estimated Value
MCL	Maximum Contaminant Level
µg/L	Micrograms per Liter
µg/m^3	Micrograms per cubic meter
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MTCA	Model Toxics Control Act
MW	Monitoring Well
NCP	National Contingency Plan
NPL	National Priorities List
NS	Not Samples
O&M	Operation and Maintenance
OU	Operable Unit
PCE	Tetrachloroethylene
POC	Point of Compliance
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RG	Remedial Goal
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
RSL	Regional Screening Level
SEIR	Summary of Existing Information Report
SVE	Soil Vapor Extraction
Southgate	Southgate Dry Cleaners
TBC	To-Be-Considered
TCE	Trichloroethylene
trans-1,2-DCE	*trans*-1,2-Dichloroethene
U	Below Detection
UU/UE	Unlimited Use and Unrestricted Exposure

VOC	Volatile Organic Compound
WAC	Washington Administrative Code
WDOH	Washington State Department of Health
WSDOT	Washington State Department of Transportation

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP) (40 Code of Federal Regulations (CFR) Section 300.430(f)(4)(ii)) and considering EPA policy.

This is the fourth FYR for the Palermo Well Field Ground Water Contamination Superfund site (the Site). The triggering action for this statutory review is the completion date of the previous FYR (Sept. 30, 2013). The FYR has been prepared because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure (UU/UE). The Site consists of one operable unit (OU) that addresses soil and groundwater contamination on the Site.

EPA remedial project manager (RPM) Claire Hong led the FYR. Participants included EPA hydrogeologists Bernie Zavala and Tim Maley, EPA community involvement coordinator (CIC) Kay Morrison, EPA toxicologist Elizabeth Allen, EPA ecological risk assessor Joe Goulet, Norm Payton with Washington State Department of Transportation (WSDOT), Lara Linde and Brandon Brayfield with GeoEngineers Inc. (WSDOT contractor), Chris Hartman, Dan Smith and Steve Craig with the city of Tumwater (City), and Johnny Zimmerman-Ward and Claire Marcussen from EPA support contractor Skeo. The review began on 12/20/2017. The Site visit was conducted on March 22, 2018. Documents used to prepare this FYR are summarized in Appendix A. Appendix B includes a detailed chronology.

Site Background

The 150-acre Site is located in a light commercial and residential area in Tumwater, Washington (Figure 1). The western part of the Site is an uplands area that straddles Interstate 5. The western uplands area contains the Southgate Mall (which includes a dry cleaner facility), restaurants and other small businesses, government facilities, the former WSDOT materials testing lab (FMTL) and current WSDOT materials testing lab (CMTL). A 60-foot bluff separates the western uplands area from the eastern lowland part of the Site in the Deschutes River Valley. Immediately below the bluff is the eastern part of the Site that includes the Palermo residential neighborhood of about 50 houses and the Palermo City Well field (Figure 2). The well field currently utilizes six water supply wells (TW-3, -4, -6, -8, -16 and -17) drawing water from the shallow alluvium aquifer. The number of wells used, and frequency of pumping to provide drinking water for the City, depends on demand. The north-flowing Deschutes River forms the eastern boundary of the Site.

In 1993, the City detected trichloroethylene (TCE) in drinking water supply wells TW-2, -4 and -5, in which TCE was detected above the drinking water criterion (5 µg/L) in TW-2. The City temporarily removed the affected wells from service. The TCE source was determined to be historic operations conducted at the FMTL and CMTL. In addition, the City and the Washington State Department of Ecology (Ecology) identified Southgate Dry Cleaners (Southgate) as a source of tetrachloroethylene (PCE). These operations at the FMTL, CMTL and Southgate resulted in TCE and PCE releases to soil and groundwater.

Geology of the area consists of Deschutes River alluvium that has cut into older glacial deposits (Appendix G, Figure G-1). Two regional aquifer systems are reported in the study area. The uppermost aquifer system is contained within the Deschutes River Alluvium and the Vashon Drift. The Palermo Wellfield wells are completed within the Deschutes River Alluvium at total depths ranging from 70 to 110 feet bgs and with depth to water generally less than 10 feet bgs. Depth to groundwater in the upland Site wells is approximately 35 to 55 feet bgs. Depth to groundwater in lower valley monitoring wells is approximately 1 to 8 feet bgs with artesian conditions observed at some locations near the base of the bluff.

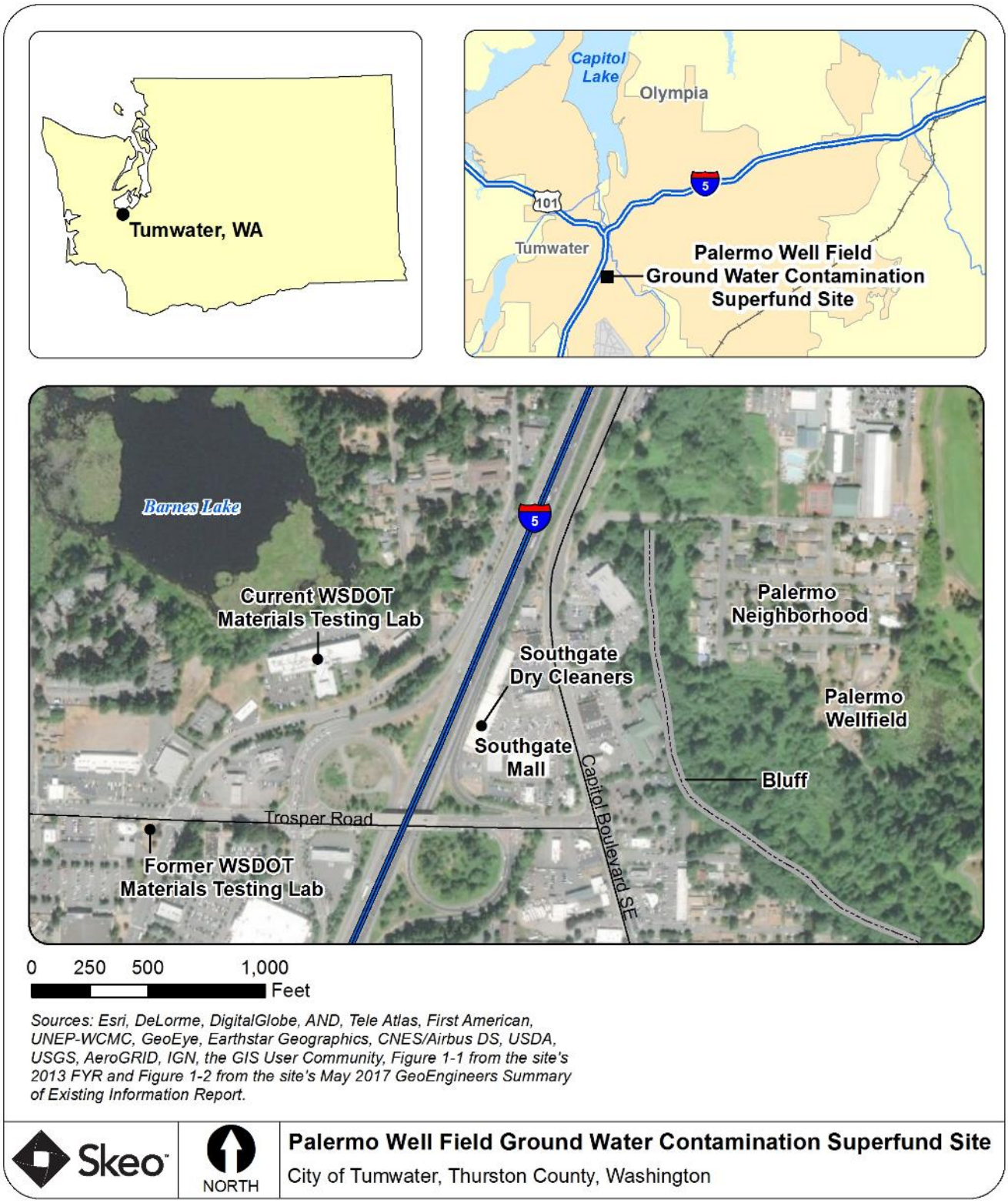
Groundwater flow across the study area is easterly with a hydraulic gradient of approximately 0.03 feet per foot. The lower aquifer is identified as the Penultimate Drift, located beneath the interglacial, fine grained deposits of the Kitsap Formation. The Kitsap Formation is reportedly a confining layer to the Penultimate Drift. All the site wells are completed in the upper-most aquifer system.

There are two surface water features near the Site: a treatment lagoon (located northeast of the Palermo neighborhood) which accepts water collected by a subdrain system, promotes aeriation, and then ultimately discharges the water 2,000 feet north, into the Deschutes River (which flows north, away from the Palermo neighborhood) (Figure 2), and Barnes Lake, which is located behind the CMTL facility (Figure 1).

FIVE-YEAR REVIEW SUMMARY FORM

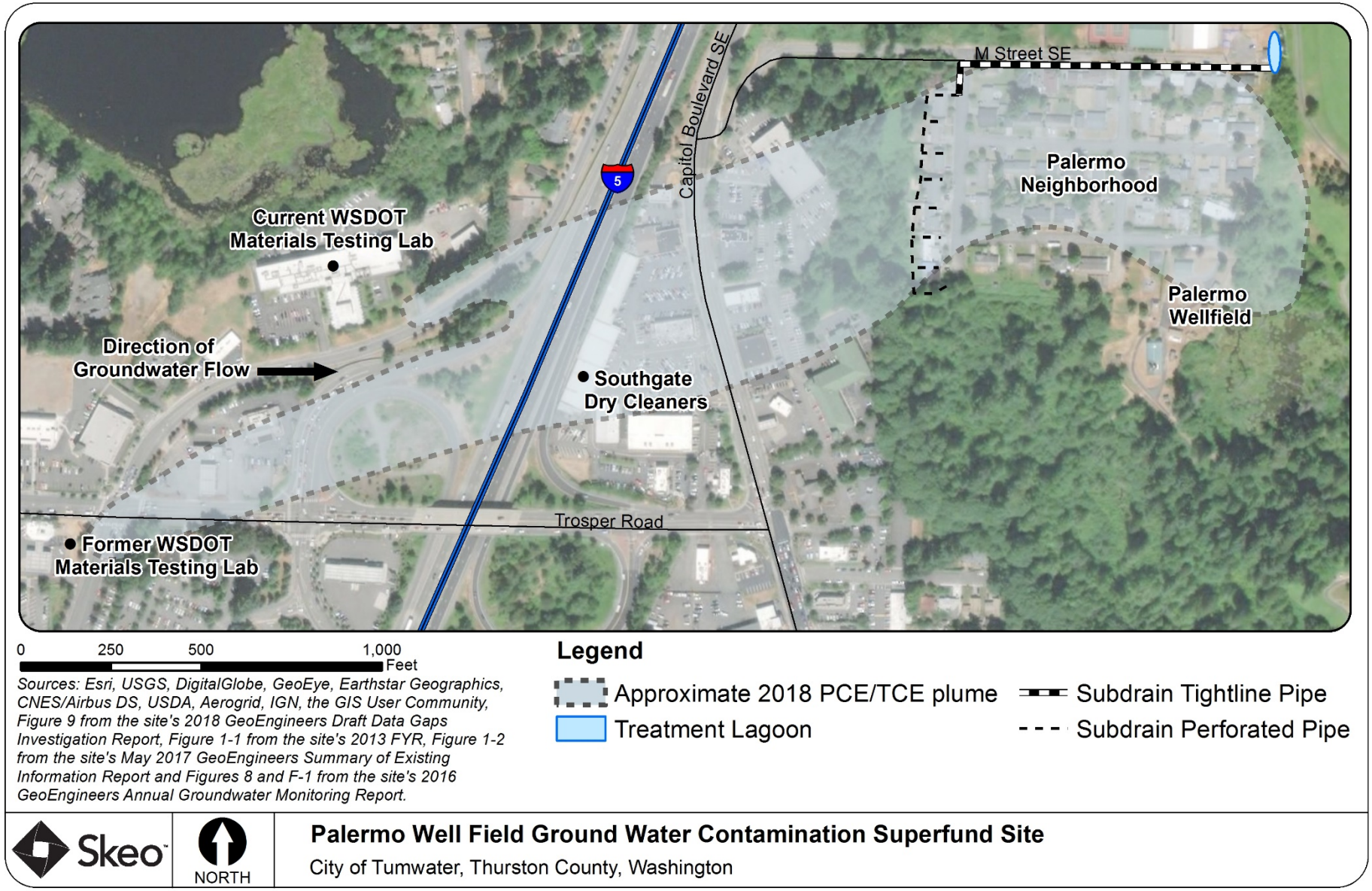
SITE IDENTIFICATION		
Site Name: Palermo Well Field Ground Water Contamination		
EPA ID: WA0000026534		
Region: 10	**State:** WA	**City/County:** Tumwater/Thurston
SITE STATUS		
NPL Status: Final		
Multiple OUs? No	**Has the Site achieved construction completion?** Yes	
REVIEW STATUS		
Lead agency: EPA		
Author name: Claire Hong, with additional support provided by Skeo		
Author affiliation: EPA Region 10		
Review period: 12/20/2018 – 9/7/2018		
Date of site inspection: 3/22/2018		
Type of review: Statutory		
Review number: 4		
Triggering action date: 9/30/2013		
Due date *(five years after triggering action date)*: 9/30/2018		

Figure 1: Site Vicinity



Disclaimer: This map and any boundary lines within the map are approximate and subject to change. The map is not a survey. The map is for informational purposes only regarding EPA's response actions at the Site and is not intended for any other purpose.

Figure 2: Site Detail



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II. RESPONSE ACTION SUMMARY

Basis for Taking Action

Investigations by the City and Ecology between 1988 and 1993 identified a plume of TCE and PCE in groundwater emanating from sources upgradient of the Palermo Well field. EPA listed the Site on the Superfund program's National Priorities List (NPL) in April 1997. Between 1997 and 1999, EPA collected samples of soil, groundwater, ponded water in residential crawl spaces, and surface water as part of the remedial investigation, which indicated contamination. EPA then completed baseline human health and ecological risk assessments, which indicate that risks associated with groundwater, surface water, soil and indoor air at the Site are above acceptable risk levels. A summary of the contaminants of concern (COCs) identified in the Site's 1999 Record of Decision (ROD) and environmental media is presented in Table 1. Although PCE and TCE can break down to *cis*-1,2-dichloroethylene, *trans*-1,2-dichloroethylene and vinyl chloride, there is no evidence of this occurring at the Site. Thus, the COCs identified for the Site are PCE and TCE.

Table 1: Site COCs, by Media

COC	Subsurface Soil[a]	Groundwater[b]	Indoor Air[c]
PCE	X	X	X
TCE	X	X	X

Notes:

a. Surface soil did not pose unacceptable risks for direct contact; however, contaminated subsurface soils pose a risk by serving as a residual source of contaminants to groundwater.
b. Includes groundwater from wells and groundwater that has seeped to the surface in crawl spaces which is referred to as "surface water" in the 1999 ROD.
c. Based on modeled indoor air from groundwater that surfaced into the crawl spaces.

Response Actions

EPA completed two removal actions by installing a soil vapor extraction (SVE) system at Southgate Dry Cleaners in 1998 and a wellhead treatment system (two air strippers) at the Palermo Well field, which began operation in February 1999. EPA selected the long-term cleanup plan in the October 1999 ROD that included continued operation of the SVE and wellhead treatment systems, as well as construction of a subdrain and treatment lagoon designed to intercept contaminated groundwater and lower the water table elevation in the Palermo residential neighborhood. A detailed summary of the remedial action objectives (RAOs) and remedy components is in Table 2. The remedial goals for PCE and TCE are listed in Table 3. Due to the limited anaerobic biodegradation across the Site, only low concentrations of PCE and TCE breakdown products were detected in all media sampled. Therefore, the risk assessment did not identify PCE and TCE degradation products as COCs. However, the ROD requires long-term monitoring of groundwater to include PCE and TCE and breakdown products, to monitor if site environmental conditions change.

Table 2: RAOs and Remedy Components

Environmental Medium	RAO[a]	Remedy Components[b]
Subsurface Soil	Prevent soil from contaminating groundwater above health-based levels.	• Treat contaminated soil at the Southgate area with the SVE system installed during the removal action. • Place deed restrictions on the Southgate property to reduce the future transfer of contaminants from soil to groundwater.
Groundwater	Clean up the aquifer.	• Treat groundwater withdrawn by the Palermo Well field by continuing operation and maintenance of the air stripper system. • Implement long-term groundwater monitoring program to include PCE, TCE and degradation products.

Environmental Medium	RAO[a]	Remedy Components[b]
	Prevent ingestion of, or exposure to, groundwater containing carcinogens in excess of applicable or relevant and appropriate requirements (ARARs) and total excess cancer risk greater than 10^{-4} to 10^{-6}.	• Implement informational institutional controls to notify property owners, well drillers and local officials regarding the location of the groundwater contaminant plume. The notification will advise that the groundwater in this area is not safe for domestic use without treatment.
	Prevent inhalation of COC vapors from surface water in residential crawlspaces at concentrations that result in a total excess cancer risk greater than 1 x 10^{-6}.	• Install a subdrain west of the residences along the west side of Rainier Avenue to lower the water table 18 inches below the bottom of the building crawl spaces. • Evaluate standing water in the Palermo community and determine if remedial action is necessary by either lowering the water table beneath the houses or by venting the crawl spaces. • Implement a sampling program to assess indoor air quality.
Surface Water	Prevent discharge of groundwater containing COCs to the Deschutes River at concentrations in excess of ARARs or resulting in an ecological hazard index (HI) greater than 1.	• Construct an aeration lagoon to treat the shallow contaminated groundwater collected from the subdrain and discharge the water to the stormwater drain that flows to the Deschutes River. • Develop and implement a monitoring system for the discharge from the aerated lagoon to confirm that the water in the lagoon meets water quality standards before discharge to the Deschutes River.

Notes:
a. RAOs for soil, groundwater/air and surface water are listed in Table 7-1 of the ROD. Because shallow groundwater surfaces below the crawl spaces of some residential homes, this water is referred to as surface water.
b. Remedy components consistent with Section 10.2 of the 1999 ROD.

Table 3: Remedial Goals Established in the ROD

	ROD Remedial Goals				
		Groundwater (µg/L)			
COC	Soil (mg/kg)[a]	Crawlspace[b]	Public Supply Wells[c]	Surface Water (µg/L)[d]	Indoor Air (µg/m^3)[e]
PCE	0.0858	0.05	5	0.8	4.38
TCE	0.398	0.27	5	2.7	1.46

Notes:
a. Leachability-based values were calculated using the Model Toxics Control Act (MTCA) Method B for entire soil column.
b. According to the ROD, the remedial goals listed are less than standard analytical detection limits. The actual remedial goal will be the method detection limit for the analytical method used. These remedial goals were established to help ensure that air cleanup goals for of 1.46 µg/m^3 for TCE and 4.38 µg/m^3 for PCE are met in the residences along Rainier Avenue.
c. Federal Safe Drinking Water Act maximum contaminant levels (MCLs) and MTCA Method B groundwater remedial goals at the time of the ROD applied to public supply wells post-treatment.
d. National Toxics Rule - Federal Clean Water Act - National Toxics Rule 40 CFR 131.36(b)(l) Human Health (10^{-6} cancer risk for consumption of water and organisms) applied to the treatment lagoon.
e. MTCA Method B risk-based indoor air concentrations.
mg/kg = milligrams per kilogram
µg/L = micrograms per liter
µg/m^3 = micrograms per cubic meter

Status of Implementation

A summary of the implementation of each remedy component is provided below.

Wellhead Treatment
The wellhead treatment system was constructed between February 1998 and February 1999. Testing and optimization of the treatment system occurred between January and June 1999. Operation and maintenance (O&M) of this system was transferred to the City in April 1999. The City recently completed a well field expansion program to increase production at the well field. Since the air strippers were installed, the City had been operating three of the original six production wells (TW-4, TW-6 and TW-8) to produce water for public consumption. The City decommissioned production wells TW-2 and TW-5 in 2013 and 2014, respectively. A third well, TW-3, remains inactive due to its lower pump rate. The City installed two new production wells (TW-16 and TW-17) in 2012 and 2014, respectively, to replace the two decommissioned wells. In early 2016, the City connected new supply wells TW-16 and TW-17 to the air stripping treatment system to bring them into use and increase production of the well field. The City changes the number of production wells in use based on water demand.

Subdrain and Treatment Lagoon System
EPA conducted the remedial design for the subdrain and treatment lagoon systems between November 1999 and June 2000. During subdrain design, EPA evaluated the presence or absence of standing water in residential crawl spaces in the Palermo neighborhood, and any standing water present was sampled. EPA concluded that only homes on the west side of Rainier Avenue required drainage, but that conveyance piping under Rainier Avenue and M Street should be oversized to allow future expansion of the drain system, if necessary. The subdrain design was expected to have some influence under homes on the east side of Rainier Avenue, with a decreasing influence farther east. EPA constructed the subdrain system and treatment lagoon between August 8, 2000, and January 9, 2001. In 2002, EPA began a long-term groundwater monitoring program and monitoring of subdrain and treatment lagoon performance.

The ROD goal for subdrain performance was to lower the groundwater elevation to 18 inches below the crawl space floors for homes west of Rainier Avenue. The floors of these crawl spaces were conservatively estimated to be 18 inches below ground surface (bgs). Ecology assumed responsibility for performing O&M of these facilities in February 2002. Ecology then transferred some O&M responsibilities to the City. The City assumed physical maintenance responsibility for the property easements, equipment, and structures that make up the system.

In 2005, the U.S. government initiated a cost-recovery case against two potentially responsible parties (PRPs), WSDOT and Southgate Development Corp. In 2007, a settlement was finalized with Southgate regarding PCE contamination, and the court issued a judgment identifying WSDOT as liable for part of the past and future response actions related to TCE contamination at the Site. Until 2009, Ecology was responsible for water quality sampling and measurement of parameters, such as groundwater depths and water flow rate. These responsibilities were transferred back to EPA in 2009 and then to WSDOT in 2012 as part of the July 2012 Administrative Settlement Agreement and Order on Consent (ASAOC) between EPA and WSDOT. The ASAOC required that WSDOT perform monitoring across the Site, to take over the maintenance of components of the remedy that are not being maintained by the City of Tumwater, to reimburse EPA for future response costs, and to perform a supplemental remedial investigation and feasibility study (RI/FS) at the Site. The supplemental RI/FS is focused on all potential exposure pathways including any potential vapor intrusion, better characterization of the source areas and a more complete delineation of the plumes.

SVE
EPA installed the SVE system near the Southgate PCE source in 1998 which operated from March 1998 to June 2000. EPA decommissioned the SVE system in 2000. Pre- and post-SVE soil samples demonstrated that the SVE system had reduced PCE concentrations in soil but that concentrations still remain above the remediation goal of 0.0858 milligrams per kilogram (mg/kg).

Additional Data Gap Studies
In 2011 EPA completed an Optimization Evaluation to identify opportunities to improve remedy protectiveness, effectiveness, and cost efficiency, and to facilitate progress toward site completion. The Optimization Evaluation concluded that:

- The TCE/PCE groundwater plumes were not defined.
- Plume capture by the subdrain and well field may not be complete.
- Vapor intrusion remains a concern.
- It is unclear whether the historically identified TCE/PCE sources are ongoing sources for groundwater contamination at the CMTL, FMTL and Southgate.

In 2013, WSDOT began air and groundwater monitoring as outlined in the 2012 ASAOC and associated work plans to address the 2011 Optimization Evaluation. WSDOT completed a draft Data Gap Investigation Report (DGR) in 2018 to fulfill data gaps identified in the 2011 Optimization Evaluation. The data presented in the draft DGR confirmed that the Southgate area may have ongoing sourcing of PCE to groundwater; however, several data gaps remain, which WSDOT is addressing with additional investigations.

EPA will continue to evaluate the PCE soil and groundwater data collected in 2018 and ongoing monitoring while it prepares a supplemental RI and FS for the Site. EPA is finishing their supplemental Southgate Area PCE investigation, which will provide additional information for the supplemental RI and FS. Using information from these investigations and monitoring efforts, EPA and WSDOT will identify and screen remedial technologies to support the FS for both the TCE and PCE contamination, develop remedial alternatives, and select a remedy.

Institutional Control (IC) Review

Because the Site is within a developed area served by municipal water systems, there are no private wells that could constitute additional points of exposure to groundwater. Further, the City restricts well installation in areas where a municipal water supply is available. Thus, the ROD selected informational institutional controls to notify property owners, government officials and well drillers about the extent of the area of groundwater containing PCE and TCE to ensure that no supply wells will be inadvertently drilled into the plume of groundwater contamination. In addition, the City's Wellhead Protection Ordinance Chapter 16-26 and the Aquifer Protection Overlay Ordinance Chapter 18-39 are enforced. These ordinances protect groundwater and the municipal water supply by prohibiting certain land uses within wellhead protection areas and city limits.

The 2013 FYR Report stated that a fact sheet discussing the contaminated groundwater was mailed to well drillers and property owners in the area. Although not required by the ROD, WSDOT sent fact sheets to Palermo neighborhood residents about air monitoring required by the ASAOC. In 2013 and 2017, EPA held public meetings to inform the neighborhood of ongoing vapor intrusion and groundwater contamination studies and will continue such meetings as warranted.

The ROD required institutional controls at the Southgate property intended to reduce transfer of residual soil contamination to groundwater because a confirmation soil sample collected after decommissioning of the SVE system detected PCE above the remedial goal. The institutional control has not yet been recorded for the Southgate parcel to ensure the building and asphalt parking lot to function as a barrier. A summary of the institutional controls planned or in place is provided in Table 4.

Table 4: Summary of Planned and/or Implemented Institutional Controls (ICs)

Media That Do Not Support UU/UE Based on Current Conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater	Yes	Yes	Area above the PCE and TCE plumes	Prohibit certain land uses within wellhead protection areas and within city limits. [1]	City of Tumwater Wellhead Protection Ordinance Chapter 16-26 and Aquifer Protection Overlay Ordinance Chapter 18-39
				Prevent the use of groundwater for potable purposes within the Palermo neighborhood.	There is no ordinance currently in place restricting the installation of private drinking water wells within the Site; however, the City restricts installation in areas where municipal water is available. Informational institutional controls have been implemented, as required by the ROD.
Soil	Yes	Yes	Southgate Property	Reduce the transfer of contaminants from soil to groundwater.	EPA intends to start working with the property owner to file an institutional control on the property once the supplemental RI/FS is completed.

Systems Operations/Operation and Maintenance (O&M)

Wellhead Treatment Air Stripper Operations

O&M of the wellhead treatment air strippers includes weekly, monthly, semi-annual and annual maintenance, including periodic change-outs of air filters, equipment lubrication and cleaning, and equipment repair or replacement, as needed. The City conducts O&M of the wellhead treatment air strippers. WSDOT samples air stripper effluent as part of long-term groundwater monitoring. The wellhead treatment system captures and treats hundreds of millions of gallons of water each year. Based on information from the City, it appears that production from the Palermo Well field has been decreasing for the past decade, with other groundwater sources (primarily the Bush Middle School Well field about two miles southwest of the Site) making up more of the city water supply. The City is currently evaluating ways to increase the flow rate from the Palermo Well field,

[1] The following uses are prohibited in the designated six-month and one-year wellhead protection areas: 1) land spreading disposal facilities; 2) agricultural operations, including stockyards and feedlots involving the raising or keeping of farm animals; 3) gas stations, petroleum products refinement, reprocessing and storage (except underground storage of heating oil or agricultural fueling in quantities less than 1,100 gallons for consumptive use on the parcel where stored, and aboveground storage for emergency utility purposes), and liquid petroleum products pipelines; 4) automobile wrecking yards; 5) wood waste landfills; and 6) dry cleaners, excluding drop-off only facilities. The following uses are prohibited in the designated six-month, and one-, five- and 10-year wellhead protection areas as depicted on the wellhead protection map available for inspection in the city's community development department: 1) landfills (municipal sanitary solid waste and hazardous waste); 2) hazardous waste transfer, storage and disposal facilities; 3) wood and wood products preserving; and 4) chemical manufacturing. Accessed on 4/24/2018:
http://www.codepublishing.com/WA/Tumwater/html/Tumwater16/Tumwater1626.html#16.26.040.
http://www.codepublishing.com/WA/Tumwater/html/Tumwater18/Tumwater1839.html

including rehabilitation of existing well TW-3 and the installation of two new wells, TW-16 and TW-17, which replaced decommissioned wells TW-2 and TW-5.

Subdrain and Treatment Lagoon Operations
O&M of physical components of the subdrain system and treatment lagoon follows the 2002 O&M Manual for the Subdrain System and Treatment Lagoon and the 2013 and 2014 O&M Amendment Manuals. The City operates and maintains the subdrain/aeration lagoon system. Pursuant to the ASAOC, if the City fails to fulfill its obligations for the system, WSDOT will ensure that the system operates consistent with the O&M Manual and its amendments. O&M activities include collection of water samples from eight subdrain and treatment lagoon locations and measurement of sediment accumulation and discharge rate at 11 subdrain locations. O&M for the treatment lagoon includes semi-annual monitoring of lagoon inflows and treatment lagoon effluent and ensuring compliance with remedial goals at the compliance point (Station 364) at the Deschutes River Outfall, which is located 2,000 feet downstream from the treatment lagoon. Sediment accumulation monitoring occurs annually at the treatment lagoon. The City performs periodic inspections of the lagoon aerators, repairs and/or replaces the lagoon aerators as needed and maintains property easements. WSDOT reports that the lagoon system operates as designed and treated water meets remedial goals before discharge to the Deschutes River.

SVE System Operations and Maintenance
The SVE system at Southgate was decommissioned in 2000; O&M is no longer needed for this remedy component.

Long-term Air and Groundwater Monitoring
Semi-annual groundwater monitoring has continued on a relatively regular schedule since 2001. Water levels are collected semi-annually at monitoring wells and piezometers. Annual long-term monitoring reports detail sampling results. WSDOT is responsible for long-term groundwater monitoring.

III. PROGRESS SINCE THE PREVIOUS REVIEW

This section includes the protectiveness determinations and statements from the previous FYR as well as the recommendations from the previous FYR and the status of those recommendations.

Table 5: Protectiveness Determinations/Statements from the 2013 FYR Report

OU #	Protectiveness Determination	Protectiveness Statement
Sitewide	Protectiveness Deferred	At this time, a protectiveness determination of the remedy at the Palermo Well Field Superfund Site cannot be made for the Site until further information is obtained. The actions necessary to make the protectiveness determination and deadlines for completion are above. It is expected that these actions will take a total of 4 years to complete, at which time a protectiveness determination will be made.

Table 6: Status of Recommendations from the 2013 FYR Report

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
The potential risks from vapor intrusion in the Palermo neighborhood remain a concern.	Complete evaluation of groundwater-to-indoor-air pathway and conduct sufficient air monitoring to determine whether TCE and PCE vapor concentrations in indoor air remain below the remedial goal of 1.46 µg/m^3 and 4.38 µg/m^3, respectively.	Ongoing	WSDOT completed additional soil vapor and indoor air sampling in the winter, spring and fall of 2017. The data will be evaluated in a revised baseline risk assessment in an upcoming RI/FS. Results showed one home exceeded the remedial goal for site-related TCE. WSDOT offered to install a vapor intrusion mitigation system, but the home owner declined.	NA

Issue	Recommendations	Current Status	Current Implementation Status Description	Completion Date (if applicable)
The effectiveness of the Palermo well field system at capturing and controlling contaminant migration requires further evaluation.	Conduct a three-dimensional capture zone analysis to assess whether the contaminant plumes are being fully captured by the operation of the Palermo Well field.	Completed	WSDOT presented an updated capture zone analysis in the Site's January 2018 draft DGR. Although EPA continues to review the draft results, the draft conclusions indicate that the TCE plume would not be entirely captured at the current average usage rates. An updated capture zone analysis indicated that the full targeted capture zone could be obtained by pumping the active well field wells continuously at a maximum, though unlikely sustainable rate.	1/26/2018
TCE and PCE groundwater plumes need better definition; characterization of the soil and groundwater is not complete at the three source areas, and plume capture by the subdrain and well field is likely not complete.	Evaluate the lateral and vertical distribution of contaminants within the aquifer.	Ongoing	WSDOT completed lateral and vertical TCE and PCE extent evaluations in 2018. WSDOT concluded that the extent of TCE was completed at the FMTL. However, the northern horizontal extent of the TCE plume remains a data gap at the CMTL. WSDOT also determined that the subdrain is not completely capturing groundwater contamination near cleanout location 6 (C6). EPA completed additional PCE groundwater sampling in October and November 2017 at Southgate but the investigation and report has not yet been finalized.	NA
TCE in soil at the former and current WSDOT facilities and PCE in soil at Southgate Dry Cleaners may continue to be sources of contamination to groundwater because it is unknown if significant masses remain in vadose zone soil or in shallow groundwater. Institutional controls, such as a deed restriction for the Southgate Dry Cleaners property, may be needed if investigations determine that residual contamination is present and poses a potential human health risk.	Complete investigations at known and potential source areas and determine if institutional controls, such as a deed restriction for the Southgate Dry Cleaners property are needed.	Ongoing	WSDOT completed additional source area evaluations at FMTL and CMTL in 2017 and 2018 and concluded residual TCE is not at levels of concern at the FMTL or CMTL. EPA conducted an additional investigation regarding residual PCE at Southgate and concluded that there is residual PCE in soil and groundwater above remedial goals that are intended to protect groundwater from contamination in soils. These results support the need for an institutional control to ensure the building and asphalt parking lot function as a barrier at the Southgate area. The detections in soil, however, are below residential screening levels.	NA
The long-term groundwater monitoring system requires further evaluation.	Based on Actions 2 to 4, determine whether the current groundwater monitoring well network is adequate to monitor plume migration and gauge the effectiveness of remediation. Install additional monitoring wells, if necessary.	Ongoing	Twenty-one new monitoring wells were installed in 2017 to support characterization of source areas, evaluation of the lateral and vertical extents of PCE and TCE in groundwater, and a more detailed understanding of chemical migration pathways. Additional monitoring well installations are planned.	NA
New toxicity information on TCE and PCE may affect the protectiveness of the remedy.	Determine whether cleanup levels need to be modified based on new toxicity information on TCE and PCE.	Ongoing	A supplemental RI/FS is being completed, including evaluation of cleanup levels based on current toxicity information.	NA

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Community Involvement and Site Interviews

EPA published a public notice in the *Olympian* newspaper on 3/22/2018 (Appendix C). It stated that the FYR was underway and invited the public to submit any comments to EPA. The results of the review and the report will be made available at the Site's information repository, Tumwater Timberland Library, located at 7023 New Market Street in Tumwater, Washington.

During the FYR process, interviews were conducted to document any perceived problems or successes with the remedy that has been implemented to date**.** The completed interview forms are presented in Appendix D and are summarized below.

Lara Linde with GeoEngineers, WSDOT's O&M Contractor: Ms. Linde indicated that the project has made significant progress in the last two years, gaining a better understanding of current groundwater dissolved phase solvent contamination and water quality conditions across the Site. Semi-annual groundwater monitoring data generally indicate that concentrations of Site contaminants are slowly decreasing over time. She also indicated that components of the remedy are effective in removing Site contamination from groundwater, including the stripper towers and portions of the subdrain system. The subdrain system is not meeting the performance criteria to lower the water table and this might not be practicable as envisioned because of artesian conditions in the area. Ms. Linde indicated that GeoEngineers recommends revising the performance criteria for the southern segment of the subdrain based on flow measurements. GeoEngineers recommends that long-term groundwater monitoring be reduced to a nine-month frequency; GeoEngineers also recommends the subdrain and treatment lagoon O&M plan be amended to a nine-month sampling frequency so these activities can be efficiently coordinated.

Norman Payton with WSDOT: Mr. Payton indicated that the project has made substantial progress since the previous FYR; additional sampling has helped define the groundwater contaminant plume and vapor intrusion sampling has provided better understanding of this exposure pathway. He believes the City's stripper towers continue to effectively remove TCE before the water is introduced to the City's drinking water system. The aeration lagoon continues to treat water removed from the subdrain system to action levels. The subdrain is not meeting performance criteria to lower the water table to depths below specific levels below neighborhood homes. Mr. Payton has received inquiries from a local business that raised concerns for office worker safety while field work was occurring near their office building in the Southgate area. Mr. Payton indicated that his office has routine communication with the general public and the City by distributing information about upcoming meetings, sampling events, air monitoring results and access agreements. Mr. Payton is not aware of any potential changes in projected land use at the Site.

Dan Smith with the City of Tumwater: Mr. Smith believes the treatment system on the city's water supply is effective and the system is easy to maintain. He feels well informed about the project by all parties, including EPA, WSDOT and Ecology. He indicated that measures are in place that restrict placement of wells for potable and irrigation uses within the drinking water system's boundaries.

Andrew Smith with the Department of Ecology, State of Washington: Mr. Smith believes cleanup activities are being conducted according to the design to protect the public and the environment and he is comfortable with the institutional controls in place. He indicated that the contaminant concentrations in the well field wells are below Model Toxics Control Act (MTCA) standards and the contaminant plume is reducing in size. Mr. Smith is not aware of any residential complaints or inquiries related to the Site cleanup. He indicated that Ecology is updating its cleanup levels to reflect the new EPA toxicity values for TCE.

Resident 1 in the Palermo neighborhood: Resident 1 has lived in the neighborhood for almost five years and is well informed about the Site's history and ongoing monitoring. The local community does not talk about the Site. The neighborhood's Facebook page includes limited information about the Site, except when EPA had an informational event at a local park. Resident 1 believes that the community receives good communication from

WSDOT and GeoEngineers. Resident 1 recommends sharing additional EPA information through the neighborhood Facebook page.

Resident 2 in the Palermo neighborhood: Resident 2 is aware of Site activities and believes the public outreach and education has been great. People do not seem frustrated and Resident 2 has not heard any concern about home values declining. Resident 2 would like the community to receive electronic versions of handouts by email after receiving the hard copies. Overall, EPA has kept the community well informed through in-person meetings and calls. Resident 2 also stated that GeoEngineers has been great about reaching out to the neighborhood.

Representative from local business: The business person indicated they were not informed of Site activities by EPA until they received handouts and drawings from EPA in 2016 and September 2017 to inform the business of upcoming groundwater monitoring. The business person indicated that GeoEngineers was very helpful in explaining the sampling activities; the business staff had a lot of questions because information focused on what activities were occurring but not why they were occurring. The business person was frustrated that EPA could not explain why the sampling was happening and indicated that EPA could not provide anything in writing about the sampling until it was finalized. The business person emphasized the importance of providing business owners with easy-to-understand explanations of what is occurring and the purpose of the samples so that staff are not afraid. The business person would like EPA to update its website to reflect the current site status and email them and other impacted business owners regularly, to help address the concerns of the business staff.

Data Review

This section details contaminant trends for the last five years to evaluate remedy performance. A Site plan showing monitoring well locations is provided in Figure G-2.

Wellhead Treatment System

For this FYR period, five of the six city production wells were sampled on a semi-annual basis (TW-4, TW-5, TW-8, TW-16 and TW-17) between 2013 and 2017. TW-5 was decommissioned in January 2014 due to scale build-up; data are available through 2013 for this well. The number of production wells used and frequency of pumping for production varies depending on demand. PCE concentrations in production well samples have been below laboratory detection limits (1 microgram per liter, or µg/L) throughout the review period. TCE has been detected in TW-4 and TW-16 prior to treatment and concentrations in TW-16 exceeded the ROD remedial goal (5 µg/L) since it was installed in 2014 (see Table G-1). These measurements are concentrations in groundwater prior to treatment. Air stripping effectively removes TCE and PCE from groundwater and air stripper effluent samples are consistently below laboratory detection limits.

Well Field Capture Zone

WSDOT presented an updated capture zone analysis in two draft reports in 2018. The draft DGR and the Draft 2017 Annual Groundwater Monitoring Report include an initial capture zone analysis to assess potential pumping scenarios that could capture the plumes during Palermo Well field pumping and treatment operations. Although EPA continues to review these reports, they concluded that the TCE plume above the 5 µg/L remedial goal would not be entirely captured at the current average usage rates. An updated capture zone analysis indicated that the full targeted capture zone could be obtained by pumping the active wellfield wells continuously at a maximum, though unlikely sustainable rate. Additional plume capture assessments will be performed as part of the supplemental FS.

Plume Delineation and Long-Term Monitoring Adequacy

Since long-term monitoring began in 2004, PCE and TCE concentrations in groundwater have gradually decreased in most wells or remained steady where these COCs were detected. WSDOT conducted statistical trend analyses where PCE or TCE has been detected. The analysis shows a statistically significant decreasing trend in PCE and TCE concentrations in most wells, piezometers and production well TW-4 (Table G-2).

The current general plume map for TCE and PCE (Figure G-3) shows that separate TCE plumes are emanating from the FMTL and CMTL, and a PCE plume is emanating from the Southgate mall area. These plumes appear to

merge together in the upland area west of Interstate 5. WSDOT is proposing additional sampling to further delineate the TCE plume near MW-111 downgradient of the CMTL facility and north of MW-DG-08. In addition, WSDOT is proposing additional monitoring wells east of MW-DG-10, near MW-DG-16 and near MW-110 to delineate the vertical extent of TCE in the upper aquifer. EPA is performing a supplemental PCE investigation at the Southgate Dry Cleaners portion of the Site to further delineate the PCE plume and better understand its interaction with the TCE plume in this area.

Subdrain System and Treatment Lagoon

The subdrain system intent is to intercept shallow groundwater previously ponding in backyards and crawl spaces behind the seven southernmost houses west of SE Rainier Avenue (Figure G-4) and conveys the collected water to the treatment lagoon at the Tumwater Municipal Golf Course. Sampling data indicates that, as contaminated groundwater travels through the subdrain and is treated by aeration in the treatment lagoon, PCE and TCE concentrations are reduced to levels below the ROD-established water quality limit at the Deschutes River outfall (Table G-3). Although the treatment lagoon effectively meets outfall criteria, the subdrain system is not entirely capturing shallow contaminated groundwater at the southern end, and sometimes at the north end, of Rainier Street due to artesian conditions. The supplemental RI/FS will identify additional remedies to address this concern.

Soil Vapor Extraction System at Southgate Dry Cleaners

The SVE system was decommissioned in 2000, when the average soil concentrations met the ROD remedial goal for PCE in soil. Based on recommendations of the 2011 Optimization Evaluation, EPA conducted a supplemental investigation for PCE in October and November 2017, of which subsurface soil sampling data in the Southgate area contained PCE at levels above the ROD remedial goal (maximum PCE of 2.2 mg/kg) (Table G-4). This indicates that soils could be a continual source of contamination to groundwater.

Soil Vapor and Indoor Air

WSDOT completed a screening-level evaluation of vapor intrusion risks in 2017 as summarized in the Summary of Existing Information Report (SEIR) for the FMTL, CMTL and Southgate commercial areas using indoor air concentrations modeled from groundwater data collected in 2012. WSDOT also evaluated vapor risks in the Palermo neighborhood using indoor air and crawl space data collected from 2013 through 2017. A summary of the vapor intrusion analysis conducted at the commercial areas and the Palermo neighborhood are summarized below.

Commercial Areas

The conservative vapor intrusion screen demonstrated that commercial/industrial cancer risks for the FMTL and CMTL were less than 1×10^{-6} and less than the noncancer HI of 1 (Table G-5). Using maximum concentrations found at any depth in the Southgate area, the conservative vapor intrusion screen would result in an estimated risk of 4×10^{-6} and estimated HI of 1. The Southgate screening numbers were based on the TCE concentration in deeper aquifer monitoring well MW-ES-02. However, where contaminated groundwater is a potential vapor source, EPA vapor intrusion guidance recommends use of groundwater samples obtained in the uppermost portion of the aquifer that underlies the study area of interest[2]. If the assessment utilized the groundwater data from shallow wells in this area, groundwater concentrations are below the commercial vapor intrusion screening levels. To confirm these results, WSDOT plans additional vapor intrusion evaluation at the Southgate area.

WSDOT conducted a future residential risk evaluation at the FMTL, CMTL and Southgate commercial areas in the SEIR. If these commercial areas were used as residential areas, residential risks at these areas would exceed the risk level of 1×10^{-6} or the noncancer HI of 1 (Table G-5). WSDOT plans to conduct additional vapor intrusion evaluation because a child daycare facility is located near the CMTL. September 2017 PCE and TCE concentrations in the groundwater monitoring wells used in the vapor intrusion evaluation are slightly lower than 2012 concentrations used in the SEIR. Therefore, potential risks and hazards in this area from vapor intrusion would likely be slightly lower than observed in 2012.

[2] EPA's 2015 Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air. OSWER Publication 9200.2-154.

Palermo Neighborhood

Eight rounds of air monitoring were completed in the Palermo neighborhood between the spring of 2013 and the fall of 2017. During the winter of 2017, TCE was detected for the first time in indoor air (4.4 micrograms per cubic meter, or $\mu g/m^3$) and crawl space air (3.7 $\mu g/m^3$), which are at concentrations above the ROD remedial goal of 1.46 $\mu g/m^3$, and the short-term exposure screening level of 2.0 $\mu g/m^3$. This occurred in only one home. During the spring of 2017, indoor air TCE concentration in this home was 1.8 $\mu g/m^3$ which was above the remedial goal but lower than the short-term exposure screening level. The crawl space air sample was 0.85 $\mu g/m^3$ which was below the remedial goal and short-term screening levels. WSDOT offered to install an EPA-approved vapor intrusion mitigation system after spring 2017 sampling, but the homeowner declined. This home was resampled in the fall of 2017 where TCE was detected above the ROD remedial goal and the short-term exposure screening level in indoor air (4.2 $\mu g/m^3$) and crawl space (4.8 $\mu g/m^3$) samples. After the fall 2017 results, EPA and WSDOT tried to contact the homeowners again by various methods, including phone calls and a certified mail letter with a summary of the fall 2017 results. WSDOT again offered to install a vapor intrusion mitigation system, but the homeowners have not responded to these inquiries.

Site Inspection

The FYR site inspection took place on 3/22/2018. In attendance were:

- Claire Hong, EPA RPM
- Kay Morrison, EPA CIC
- Bernie Zavala, EPA Hydrogeologist
- Tim Maley, EPA Hydrogeologist
- Elizabeth Allen, EPA Toxicologist
- Joe Goulet, EPA ecological risk assessor
- Norm Payton, Washington State Department of Transportation (PRP)
- Lara Linde, GeoEngineers (PRP contractor)
- Brandon Brayfield, GeoEngineers (PRP contractor)
- Claire Marcussen, Skeo (EPA FYR contractor)
- Johnny Zimmerman-Ward, Skeo (EPA FYR contractor)

The purpose of the inspection was to assess the protectiveness of the remedy. The site inspection checklist and photographs are provided in Appendices E and F, respectively.

Participants met near the Site and discussed remedial actions and ongoing investigations. Participants proceeded to tour the former location of the WSDOT FMTL, where a Mobil gas station is currently located. Participants then toured the Palermo Well field and groundwater treatment system near the Palermo neighborhood and observed six production wells (TW-3, -4, -6, -8, -16 and -17) and the decommissioned well (TW-5). Participants observed the interior of the pump house for TW-16, control panels and the air stripping treatment system, which includes two air stripping towers. The well field and treatment facilities appeared to be in very good condition and operational except for TW-3, which was being upgraded. Participants then visited the treatment lagoon west of the golf course where the aerators were operating. The treatment lagoon is surrounded by a locked fence. Participants then walked down Rainier Avenue to observe the drainage ditch behind homes where the subdrain system is located. The ditch appeared to be flowing and unobstructed. Participants then visited the Southgate Mall area and the CMTL area, which included a paved area where the former TCE tank was located. Barnes Lake was observed behind the CMTL facility. Lastly, participants observed the groundwater monitoring well network around the CMTL and adjacent daycare facility. All wells observed were flush mounted and secured.

Skeo staff visited the designated Site repository, Tumwater Timberland Library, located at 7023 New Market Street in Tumwater, Washington. The repository file contained the administrative record through 2013 on compact disc.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:
No, the remedy is functioning only partially as intended by the decision documents.

Wellhead Treatment System
The groundwater treatment component of the remedy (air stripping) is effective at reducing VOC contaminants below MCLs in groundwater prior to distribution.

Well Field Capture Zone
The preliminary capture zone analysis presented in the SEIR was conducted using three pumping scenarios for the Wellfield based on current average pumping rates, a maximum rate using currently actively pumped wells, and a maximum pumping rate for a proposed future usage. The results of the analysis indicated that the plume would not be entirely captured at the current usage rates. The analysis did indicate that, depending on the actual transmissivity of the aquifer, the full targeted capture zone could be obtained by pumping TW-4, TW-16 and TW-17 continuously at a maximum rate. The well field operator is not contractually obligated to operate the well field continuously to ensure complete plume capture. The well field capture zone will be re-evaluated using data collected as part of the supplemental RI/FS being conducted by WSDOT.

Plume Delineation and Long-Term Monitoring Adequacy
WSDOT and EPA have been working on filling contaminant plume delineation data gaps identified in the previous FYR Report and the 2011 Optimization Evaluation. WSDOT completed the draft DGR, which included the presentation of data to improve the delineation and characterization of the TCE plume. The recent data collected indicate that additional localized data gaps for adequately assessing plume delineation remain. EPA is completing a supplemental PCE investigation at the Southgate area and surrounding area. Data from the draft DGR, the additional investigation to fill remaining data gaps, EPA's PCE investigation results, and ongoing monitoring will be incorporated into the supplemental RI/FS. The supplemental RI/FS will include all sampling data collected to date, updated plume maps and cross-sections, an updated long-term groundwater monitoring program, and recommended additional response actions.

Vapor Intrusion Evaluation
The conservative vapor intrusion screening using existing groundwater data to model indoor air concentrations in the Southgate areas resulted in an estimated cancer risk of 4×10^{-6} and an HI of 1 due to the TCE concentration detected in deep well MW-ES-02. It should be noted that where contaminated groundwater is a potential vapor source, EPA's 2015 vapor intrusion guidance recommends use of groundwater samples obtained in the uppermost portion of the aquifer that underlies the study area of interest. If the groundwater data from shallow wells in this area are used, groundwater concentrations are below commercial vapor intrusion screening levels. To confirm results, WSDOT plans to conduct additional soil vapor sampling and evaluation at the Southgate area. In addition, WSDOT plans additional soil vapor evaluation near a daycare facility cross-gradient of the CMTL to confirm that TCE groundwater concentrations are protective of children and adults at the facility.

WSDOT also evaluated vapor intrusion in the Palermo neighborhood where the results of two indoor air samples collected in spring and fall of 2017 at one of the homes exceeded the TCE remedial goal. WSDOT offered to install an EPA-approved vapor intrusion mitigation system after the spring 2017 sampling, but the homeowner declined. After resampling this home in the fall of 2017 EPA and WSDOT tried again to contact the homeowner by various methods with a summary of the fall 2017 results and WSDOT again offered to install a vapor intrusion mitigation system. The homeowners have not responded to these inquiries.

Subdrain System and Treatment Lagoon
Based on the data presented in the 2016 Annual Report, the SEIR and the draft DGR, the subdrain system achieves ROD performance criteria in the central portion of Rainier Avenue but not at the south end area, and

sometimes not at the north end area, due to artesian conditions. Groundwater is shallower in this area than the required three feet under some homes, which can increase the risk of vapor intrusion. The treatment lagoon treats TCE and PCE concentrations to below the performance criteria. TCE and PCE are occasionally detected in receiving water outfall but at concentrations below the ROD-established water quality limit.

Soil Vapor Extraction System at Southgate Dry Cleaners
The SVE system operated from 1998 to 2000 and decommissioned in 2000. Pre- and post-SVE soil samples demonstrated that the SVE system had reduced PCE concentrations in soil but that concentrations still remain above the remediation goal of 0.0858 milligrams per kilogram (mg/kg). EPA conducted additional subsurface investigations in fall 2017 and identified additional locations in soil under the Southgate area that exceed the remedial goal for PCE. As a result, an institutional control was required to ensure the building and asphalt parking lot function as a barrier. An institutional control has not yet been filed.

Institutional Control Assessment
Because the Site is located in a developed area served by municipal water systems, there are no private wells that could constitute additional routes of exposure to groundwater. Further, a City ordinance restricts water well installation in areas where the municipal water supply is available. The institutional control required by the ROD for the Southgate property has not been filed. Public notification of contaminated groundwater was completed in accordance with the ROD. The 2013 FYR stated that a fact sheet about the contaminated groundwater was mailed to well drillers and property owners in the area. Although not required by the ROD, WSDOT sent fact sheets to Palermo neighborhood residents about air monitoring required by the ASAOC. In 2013 and 2017, EPA held public meetings to inform the neighborhood of ongoing vapor intrusion and groundwater contamination studies. EPA will continue such meetings as warranted.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels and RAOs used at the time of the remedy selection still valid?

Question B Summary:
No. Not all exposure assumptions, toxicity data, cleanup levels and RAOs at the time of the remedy selection are still valid.

According to the SEIR, incidental ingestion and dermal contact with groundwater discharging at seeps along the south and west sides of the Palermo neighborhood were identified as incomplete or minor exposure pathways based on the monitoring results of these seeps in 2012 and 2014. However, the draft DGR identified exposure to seep water as complete or potentially complete for current and future residents and recreational users. This change in designation is due to feedback received by WSDOT from Palermo neighborhood residents who expressed concerns on potential exposure to the seeps/surface water when WSDOT conducted subdrain monitoring and air monitoring activities over the past four years. WSDOT is addressing this data gap to determine if additional response action is warranted.

This FYR reviewed remedial goals to determine if they remain valid. Federal ARARs have not changed since the previous FYR (Appendix H). In the previous FYR, EPA Region 10 issued a recommendation to use a health protective TCE air concentration of 2.0 $\mu g/m^3$ for residential short-term exposures and 8.4 $\mu g/m^3$ for commercial/ industrial short-term exposures (21-day exposure) based on noncancer health effects and recommends expeditious exposure reduction if this level is exceeded.[3] In response to the EPA Region 10 recommendation, WSDOT prepared a draft Time-Critical Action Decision Matrix in 2013 to outline requirements for time-critical action if the short-term TCE level is exceeded. In addition, in the previous FYR, updated MTCA cleanup level concentrations for surface water were considered not applicable to the Site unless the current ROD-selected remedy is determined to be not protective for the surface water exposure pathway. It is recommended that risk from exposure to surface water pathway be evaluated to determine if the remedy (including ARAR revisions)

[3] Memorandum from Joyce C. Kelly, Director, Office of Environmental Assessment to Rick Albright, Director of Office of Environmental Cleanup and Kate Kelly, Director of Office of Air, Waste and Toxics, December 13, 2012.

needs to be altered by a decision document. EPA should also evaluate toxicity value changes and ARAR changes during the RI/FS and determine whether any remedial goals should be revised in a decision document once any additional remedial responses are selected. EPA should incorporate the short-term health protective level for TCE in a decision document and include the Time-Critical Action Decision Matrix.

The ROD established an RAO for shallow groundwater under residential crawl spaces but referred to this crawl space water as surface water. WSDOT recommended replacing the current RAO addressing inhalation of COC vapors from surface water in residential crawl spaces with an RAO that addresses inhalation of COC vapors from neighborhood groundwater to promote clarity in the RAOs in a future decision document.

The RAO for preventing inhalation of COC vapors from surface water in one residential crawl space at concentrations that result in total excess cancer risk greater than 1×10^{-6} is not being met. The RAO for preventing soil from contaminating groundwater has not been met at the Southgate area.

QUESTION C: Has any other information come to light that could call into question the protectiveness of the remedy?

No additional information has come to light since the previous FYR that calls into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the FYR:
None

Issues and Recommendations Identified in the FYR:

OU(s): Sitewide	**Issue Category: Remedy Performance**			
	Issue: Vapor intrusion risks in one home of the Palermo neighborhood are a concern based on short-term exposure.			
	Recommendation: Although EPA and WSDOT have made multiple attempts to contact the resident to share the indoor air results and offer mitigation of this exposure, the resident has not responded. Continue to pursue communications with the resident to mitigate this exposure pathway.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	PRP	EPA/State	12/1/2018

OU(s): Sitewide	Issue Category: Remedy Performance			
	Issue: Vapor intrusion risks have not been evaluated using soil vapor or indoor air at the Southgate area or the day care near the CMTL.			
	Recommendation: Evaluate the vapor intrusion pathway at the Southgate area and daycare facility near the CMTL using multiple lines of evidence.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	EPA/State	EPA/State	12/1/2018

OU(s): Sitewide	Issue Category: Remedy Performance			
	Issue: The previous FYR identified that new toxicity information on TCE and PCE exists that may affect the protectiveness of the remedy.			
	Recommendation: Complete additional risk characterization of human and ecological health as part of the supplemental RI/FS to determine if the remedy (including ARAR and cleanup goal revisions) need to be revised and include in a decision document.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
Yes	Yes	EPA/State	EPA/State	12/1/2018

OU(s): Sitewide	Issue Category: Remedy Performance			
	Issue: PCE and TCE have not been fully delineated in groundwater The Palermo Well Field is not achieving capture with its current usage rates. In addition, the subdrain is not capturing contaminated groundwater at the southern end and sometimes at the north end of Rainier Street due to artesian conditions.			
	Recommendation: Complete delineation of PCE and TCE in groundwater, update the capture zone analysis and evaluate whether subdrain performance can be improved.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA/State	EPA/State	8/1/2020

OU(s): Sitewide	Issue Category: Monitoring			
	Issue: Direct exposure of resident or recreational receptors to surface water ditches along the south and west sides of the neighborhood has not quantitatively been evaluated based on a current understanding of site contamination.			
	Recommendation: Collect surface water samples from the ditches and evaluate human health risks to residents and recreators.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	PRP	EPA/State	8/1/2019

OU(s): Sitewide	Issue Category: Institutional Controls			
	Issue: Due to PCE in subsurface soil above remedial goals underlying the Southgate area, restrictions are needed to prevent disturbing paved areas potentially mobilizing soil contamination to groundwater.			
	Recommendation: File an institutional control to prevent disturbing paved areas in order to prevent mobilization of soil contamination to groundwater.			
Affect Current Protectiveness	**Affect Future Protectiveness**	**Party Responsible**	**Oversight Party**	**Milestone Date**
No	Yes	EPA	EPA	8/1/2019

OTHER FINDINGS

Several additional recommendations were identified during the FYR. These recommendations do not affect current and/or future protectiveness.

- Revise the RAO for surface water under homes to refer to shallow groundwater to promote clarity and differentiate from surface water in ditches.
- Update the Site's information repository to include post-2013 documents.

VII. PROTECTIVENESS STATEMENT

Sitewide Protectiveness Statement	
Operable Unit: **Sitewide**	*Protectiveness Determination:* Not Protective
Protectiveness Statement: The remedy is not protective because VOC vapors have been detected above the remedial goal for TCE and the short-term exposure screening level, that appear to be migrating from groundwater and into one residential crawl space indoor air. Although EPA has already made repeated attempts to contact the resident to address this concern, the resident has not responded. Additional remedial response is warranted to assess and mitigate the exposure pathway or to reduce contaminant levels entering indoor air. The vapor intrusion investigations need to be completed at the Southgate area and day care facility near the CMTL using multiple lines of evidence. In addition, additional risk characterization of human and ecological health should be completed as part of the supplemental RI/FS to determine if the remedy (including ARAR and cleanup goal revisions) need to be revised and included in a decision document. To ensure long-term protectiveness of the remedy the following the actions need to be taken: • Complete delineation of PCE and TCE in groundwater, update the capture zone analysis and evaluate whether subdrain performance can be improved. • Collect surface water samples from the ditches and evaluate human health risks to residents and recreators. • File an institutional control to prevent disturbing paved areas in order to prevent mobilization of soil contamination to groundwater.	

VIII. NEXT REVIEW

The next FYR Report for the Palermo Well Field Ground Water Contamination Superfund site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

Air Monitoring Report – Fall 2017. Palermo Well Field Superfund Site Tumwater, Washington Prepared by GeoEngineers, Inc. for Washington State Department of Transportation. Draft. April 2018.

Air Monitoring Report – Winter and Spring 2017. Palermo Well Field Superfund Site Tumwater, Washington Prepared by GeoEngineers, Inc. for Washington State Department of Transportation. October 2017.

Draft 2017 Annual Groundwater Monitoring Report. Palermo Well Field Superfund Site Tumwater, Washington. Prepared by GeoEngineers, Inc. for Washington State Department of Transportation. January 2018.

2014 Annual Groundwater Monitoring Report. Palermo Well Field Superfund Site Tumwater, Washington. Prepare by GeoEngineers, Inc. for Washington State Department of Transportation. February 2017.

2015 Annual Groundwater Monitoring Report. Palermo Well Field Superfund Site Tumwater, Washington. Prepare by GeoEngineers, Inc. for Washington State Department of Transportation. April 2017.

2016 Annual Groundwater Monitoring Report. Palermo Well Field Superfund Site Tumwater, Washington. Prepare by GeoEngineers, Inc. for Washington State Department of Transportation. April 2017.

2016 Semiannual Groundwater Monitoring Report. Palermo Well Field Superfund Site Tumwater, Washington. Prepared by GeoEngineers, Inc. for Washington State Department of Transportation. April 2017.

First Five-Year Review Report: Palermo Well Field Superfund Site, Tumwater, Washington. Prepared by URS for EPA Region 10 under Remedial Action Contract No. 68-W98-228. September 2003.

Summary of Existing Information Report (SEIR). Palermo Well Field Superfund Site Tumwater, Washington Prepared by GeoEngineers, Inc. for Washington State Department of Transportation. May 2017.

Draft Data Gaps Investigation Report. Palermo Well Field Superfund Site Tumwater, Washington. Prepared by GeoEngineers, Inc. for Washington State Department of Transportation. January 2018.

Record of Decision, Palermo Well Field, City of Tumwater, Thurston County, Washington. EPA/ROD/R10-00/049. EPA Region 10, Seattle, Washington. October 1999.

Preliminary Closeout Report, Palermo Well Field Superfund Site, Tumwater, Washington. Prepared by EPA Region 10 and signed by Michael Gearhead, Director, Office of Environmental Cleanup, Region 10, Seattle, Washington. February 2001.

Office of Environmental Assessment (OEA) Recommendations Regarding Trichloroethylene Toxicity in Human Health Risk Assessment. Memorandum from Joyce C. Kelly, Director, OEA to Rick Albright, Director of Office of Environmental Cleanup and Kate Kelly, Director of Office of Air, Waste and Toxics, December 13, 2012.

Optimization Evaluation, Palermo Well Field Superfund Site, City of Tumwater, Thurston County, Washington. Office of Solid Waste and Emergency Response. November 2011.

Operation and Maintenance Manual, Subdrain System and Treatment Lagoon, Palermo Well Field Superfund Site, Tumwater, Washington. Prepared for EPA Region 10 under Remedial Action Contract No. 68-W-98-228. August 2002.

Third Five-Year Review Report: Palermo Well Field Superfund Site, Tumwater, Washington. Prepared by CH2MHill for EPA Region 10 under Contract No. 68-S7-04-01. September 2013.

APPENDIX B – SITE CHRONOLOGY

Table B-1: Site Chronology

Event	Date
City of Tumwater discovered TCE exceeding the MCL at the Palermo well field	August 1993
EPA completed an expanded site investigation	April 1996
EPA proposed the Site for listing on the NPL	December 20, 1996
EPA finalized the Site's listing on the NPL	April 1, 1997
EPA started the RI/FS	Mid 1997
EPA installed an SVE unit at Southgate as part of a removal action	March 24, 1998
EPA completed construction of wellhead treatment system as part of a removal action (construction complete)	February 1999
Initial RI/FS completed	June 30, 1999
EPA signed the Site's ROD	November 16, 1999
PRP began the remedial design for the subdrain and treatment lagoon	November 1999
PRP completed the remedial design for the subdrain and treatment lagoon	June 9, 2000
EPA decommissioned the SVE system at Southgate	June 2000
PRP began remedial construction for the subdrain and treatment lagoon	August 8, 2000
PRP completed remedial construction for the subdrain and treatment lagoon	January 9, 2001
EPA signed the Site's Preliminary Close-Out Report	February 22, 2001
PRP initiated remedial action	June 1, 2001
EPA began semi-annual long-term groundwater monitoring of the Site with periodic indoor air monitoring	August 2001
EPA completed the one-year validation period for the subdrain and treatment lagoon	January 2002
Ecology began O&M activities for the subdrain and treatment lagoon, transferring some responsibilities to the City	February 2002
EPA signed the Site's first FYR Report	September 29, 2003
EPA signed the Site's second FYR Report	September 30, 2008
EPA prepared the Site's Remedy Optimization Evaluation Report	November 11, 2011
EPA and WSDOT entered into the ASAOC	July 6, 2012
PRP prepared the draft SEIR	January 31, 2013
PRP began Palermo neighborhood air monitoring investigation for vapor intrusion	March 2013
EPA signed the Site's third FYR Report	September 30, 2013
WSDOT sampled indoor air in the Palermo neighborhood	October 2013
WSDOT sampled indoor air in the Palermo neighborhood	February 2014
WSDOT sampled indoor air in the Palermo neighborhood	September 2014
WSDOT sampled indoor air in the Palermo neighborhood	September 2015
WSDOT sampled indoor air in the Palermo neighborhood	May 2016
PRP completed the Supplemental Remedial Investigation Data Gaps Work Plan	August 10, 2016
PRP finalized the 2014 Annual Groundwater Monitoring Report	February 24, 2017
WSDOT sampled indoor air in the Palermo neighborhood	March 2017
PRP finalized the 2015 Annual Groundwater Monitoring Report	April 7, 2017
PRP finalized the 2016 Annual Groundwater Monitoring Report	April 21, 2017
PRP finalized the SEIR	May 19, 2017
WSDOT sampled indoor air in the Palermo neighborhood	May 2017
PRP prepared the Winter and Spring 2017 Air Monitoring Report	October 19, 2017
EPA collected additional soil and groundwater data at Southgate area	October/November 2017
WSDOT sampled indoor air in the Palermo neighborhood	December 2017
PRP drafted the 2017 Annual Groundwater Monitoring Report	January 10, 2018
PRP completed the draft DGR	January 26, 2018
PRP collected additional monitoring data to fill data gaps	February 2018
PRP prepared the Fall 2017 Draft Air Monitoring Report	April 2, 2018

APPENDIX C – PRESS NOTICE

EPA United States Environmental Protection Agency

Cleanup Review Underway Asking for Public Input Palermo Wellfield Ground Water Contamination Superfund Site

We would like to hear from you

The latest review of the environmental cleanup at the Palermo Wellfield Ground Water Contamination Superfund site is underway. As someone interested in or living close to the site, we want to keep you informed. If you have observations, questions, information helpful to the review team, would like to be interviewed, or have anything you would like us to discuss or consider during the review, please contact Claire Hong, EPA Project Manager, by **May 31, 2018** at 206-553-1813 | 800-424-4372 ext. 31813 or **hong.claire@epa.gov**.

About the site

The site is in a light commercial and residential area in Tumwater, Washington. In 1993, the local government detected trichloroethylene (TCE), an industrial solvent, in three of the city's drinking water supply wells. The city removed the impacted wells from service. Studies found the source of the TCE was industrial operations from former and current Washington Department of Transportation (WSDOT) facilities. A dry-cleaning facility also contaminated groundwater with tetrachloroethylene (PCE), a solvent used in dry-cleaning solutions.

About the cleanup

Several early-action and long-term remedies have been put in place at the site. A treatment system removes contaminants from the water at the Palermo Wellfield. The drinking water wells were returned to service once safe drinking water standards were ensured. EPA installed a subdrain system and conducted source cleanup at the dry cleaners. WSDOT and EPA are conducting additional studies to further delineate and characterize the TCE and PCE plumes, which mark the areas of underground contamination. This work will be used to determine if additional remedial action should be done at the site.

About the site review

When levels of contamination do not allow for unlimited use or unrestricted activity, reviews are conducted every five years. The purpose of the review is to see if the cleanup measures continue to protect human health and the environment. The 2013 site review concluded that data from ongoing site investigations are needed before EPA can make a protectiveness determination. EPA anticipates that these investigations will be completed in 2018. This is the fourth five-year review for the Palermo Wellfield site. It will be completed by September 2018.

For more information:

Visit the site page: **http://www.epa.gov/superfund/palermo**
Visit the library: Tumwater Timberland Library 7023 New Market St, Tumwater, WA

TDD /TTY users may call the Federal Relay Service at 1-800-877-8339.
Please give the operator number 206-553-1813 for Clair Hong.

APPENDIX D – INTERVIEW FORMS

Palermo Well Field Ground Water Contamination Superfund Site — Five-Year Review Interview Form

Site Name: Palermo Well Field Ground Water Contamination **EPA ID No.:** WA0000026534

Subject Name: Lara Linde **Affiliation:** GeoEngineers
Subject Contact Information: (253) 383-4940 linde@geoengineers.com
Time: 11:15 A.M. **Date:** 04/22/2018
Interview Location: Tacoma, Washington
Interview Format: Email Response
Interview Category: O&M Contractor

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   The project has made significant progress in the last two years, gaining a better understanding of current groundwater dissolved phase solvent contamination and water quality conditions across the Site that will update the conceptual site model and inform future potential cleanup alternatives.

2. What is your assessment of the current performance of the remedy in place at the Site?

   The stripper towers have continued to be effective at removing site contaminants from groundwater. The subdrain continues to be effective at transporting shallow groundwater containing site contaminants to the aeration lagoon for treatment, even though portions of the subdrain are not meeting some of the performance criteria to lower the water table. Lowering of the water table may not be practicable as envisioned because of artesian conditions in the area.

3. What are the findings from the monitoring data? What are the key trends in contaminant levels that are being documented over time at the Site?

   Semiannual groundwater monitoring data generally indicate that concentrations of site contaminants are slowly decreasing over time. Concentration trends are best described in the Draft 2017 Annual Groundwater Monitoring Report and has been excerpted below:

   Concentrations of PCE and TCE in groundwater samples collected in 2017 are generally consistent with previous monitoring events in 2013 through 2016. With one exception, concentration trends for PCE and TCE are either decreasing or stable based on Mann-Kendall trend tests performed using long-term groundwater monitoring data obtained since 2004. The TCE concentration trend in groundwater samples from piezometer PZ-719 showed a slight increasing trend; however, the concentrations remain below the ROD remedial goal of 5 µg/L. This minor increasing trend was not observed in 2013 through 2015.

4. Is there a continuous on-site O&M presence? If so, please describe staff responsibilities and activities. Alternatively, please describe staff responsibilities and the frequency of site inspections and activities if there is not a continuous on-site O&M presence.

   For the portions of O&M that WSDOT (GeoEngineers) is involved with, there is no continuous on-site presence. GeoEngineers' activities are limited to implementing the O&M Plan for the subdrain and treatment lagoon. These activities are performed twice a year for the subdrain and once a year for the lagoon.

5. Have there been any significant changes in site O&M requirements, maintenance schedules or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

   No changes to GeoEngineers' O&M tasks have taken place in the last five years.

6. Have there been unexpected O&M difficulties or costs at the Site since start-up or in the last five years? If so, please provide details.

   No unexpected O&M difficulties have been observed or unexpected costs incurred from the tasks completed by GeoEngineers.

7. Have there been opportunities to optimize O&M activities or sampling efforts? Please describe changes and any resulting or desired cost savings or improved efficiencies.

   Yes, O&M sampling and monitoring activities have been optimized so that they occur simultaneously with either indoor air monitoring or semiannual groundwater monitoring for efficiency and to provide a broader set of data for site understanding.

8. Do you have any comments, suggestions or recommendations regarding O&M activities and schedules at the Site?

   GeoEngineers' recommends revising the performance criteria for the southern segment of the subdrain to more closely reflect the current operation of the subdrain, which is affected by artesian conditions that naturally occur in this area and inhibit further reduction of the groundwater level. A suggestion to consider for a performance criteria revision for the southern segment may be an evaluation of whether flow continues throughout the southern segment (Cleanouts CO6, CO7 and CO8). This could be completed by visually observing the water inside the three cleanouts for movement (flow) and by continuing to take flow measurements that are already a part of the twice-yearly subdrain O&M activities. The remaining evaluation could consist of comparing upstream (CO8) and downstream (CO6) flow rates and visual observations to determine whether flow continues to occur. GeoEngineers recommends a monitoring reduction to a nine-month frequency at long-term groundwater monitoring locations. This recommendation is consistent with the frequency proposed in the Draft Interim Long-Term Monitoring Plan. GeoEngineers also recommends amending the subdrain and treatment lagoon O&M Plan to the same nine-month frequency so that these activities can continue to be efficiently coordinated together.

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR Report?

   The respondent should be identified as GeoEngineers.

Palermo Well Field Ground Water Contamination Superfund Site — Five-Year Review Interview Form

Site Name: Palermo Well Field Ground Water Contamination **EPA ID No.:** WA0000026534

Subject Name: Norman Payton **Affiliation:** Washington State Department of Transportation

Subject Contact Information: 360-705-7848 / paytonn@wsdot.wa.gov

Time: 3:23 P.M. **Date:** 04/12/2018

Interview Location: WSDOT Headquarters

Interview Format (circle one): In Person Phone Mail Other: Email

Interview Category: State Agency

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   The project has made substantial progress since the last FYR. With the membrane interface probe data, confirmation sampling and new wells, we have a better definition of the groundwater plume. Continued vapor intrusion sampling has provided us with a better understanding of this exposure pathway.

2. What is your assessment of the current performance of the remedy in place at the Site?

   The City's stripper towers continue to be effective in removing TCE prior to the water being introduced to the City's drinking water system. The aeration lagoon continues to treat water being removed from the subdrain system to action levels. The subdrain is not meeting performance criteria to lower the water table to depths below specific levels below neighborhood homes.

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years?

   One homeowner with indoor air results above short-term risk-based concentration for TCE (2.0 $\mu g/m^3$). requested that WSDOT install an energy recovery ventilator in their home to mitigate for TCE. WSDOT informed the homeowner that that his proposed system did not reflect EPA's guidance, and we would not be installing his option. WSDOT had offered that homeowner a combination subgrade (crawlspace + subslab) vapor barrier and depressurization system at no cost to the homeowner. The homeowner declined WSDOT's offer.

   A homeowner who sold his house in 2015 threatened to sue WSDOT due to claims he had to sell his house at a reduced price due to site contamination. Last month, this same individual requested that WSDOT disclose how much WSDOT has paid to property owners for damages from site cleanup due to TCE. Our agency responded by stating that WSDOT has not paid any dollar amount to property owners for damages within the Site for TCE.

   Approximately two months ago, a member of the public requested information on ambient TCE air levels in the site area. We referred him to the air reports located at the repository at the Timberland Library. A few years ago, two neighbors with homes near the toe of the bluff inquired about increased standing water in their back yards west of the subdrain. They were wondering if the higher water level was due to a problem with the subdrain. Numerous times, new homeowners stated that they did not know that they were purchasing a home on a Superfund site.

   Approximately one month ago, a resident asked why we need to keep coming back to do more work, and why have Superfund activities increased in the last two years.

Inquiries about the amount of field work near the 9000 Building. Inquiries about worker exposure due to levels of contaminants in soil and groundwater near the building.

4. Has your office conducted any site-related activities or communications in the past five years? If so, please describe the purpose and results of these activities.

    - Request for participation in vapor intrusion sampling via letters, post cards, door to door solicitation.
    - Distribution of air monitoring result letters.
    - Distribution of groundwater monitoring result letters.
    - Drilling notification. Flyers on doors for residents. Handouts to commercial businesses.
    - Access agreement solicitation – letters, emails, phone calls, in person.
    - Communication with City – letters, emails, phone calls, in person
    - Updates to the state legislature regarding vapor intrusion sampling.
    - Update to the Governor's Office regarding vapor intrusion sampling.
    - Presentation to an environmental science class at Olympia High School.

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy?

    No.

6. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?

    I don't believe there are any institutional controls at the Site.

7. Are you aware of any changes in projected land use(s) at the Site?

    I am not aware of any potential changes in projected land use. Dan Smith with the City would be a good contact for this question.

8. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

    As we have stated in our draft Long-Term Monitoring Plan, we believe those groundwater wells currently being sampled on a semi-annual basis could be sampled every nine months. The Optimization Evaluation stated that annual sampling is recommended for some wells.

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR Report?

    Yes.

Palermo Well Field Ground Water Contamination Superfund Site — Five-Year Review Interview Form

Site Name: Palermo Well Field Ground Water Contamination **EPA ID No.:** WA0000026534

Subject Name: Dan Smith **Affiliation:** City of Tumwater
Subject Contact Information: phone and/or email
Time: 2:55 P.M. **Date:** 05/08/2018
Interview Location: Tumwater Public Works, Office
Interview Format (circle one): In Person Phone Mail Other: Email
Interview Category: City

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   Overall, it is effective. Coordination with the parties has been excellent, particularly with the project managers. Concerns have been addressed, access needs requested well in advance, and most project activities are clearly understood before getting underway. We are very appreciative of the parties – EPA, WSDOT, Ecology and the consultants have all done a good job keeping the City in the loop and coordinating with us. Keep it up.

2. What is your assessment of the current performance of the remedy in place at the Site?

   It works! We have no detections of volatile organic compounds entering our distribution system. The system appears to be protective of public health, and it has been relatively easy maintenance.

3. What are the findings from the monitoring data? What are the key trends in contaminant levels that are being documented over time at the Site?

   (This is probably more pertinent for EPA/WSDOT, or consultants, to summarize.)

4. Is there a continuous on-site O&M presence? If so, please describe staff responsibilities and activities. Alternatively, please describe staff responsibilities and the frequency of site inspections and activities if there is not a continuous on-site O&M presence.

   Yes. City staff maintain the Well field and treatment system regularly and are accessible 24/7, throughout the year. Standard operational hours are 7 a.m. through 5:30 p.m. After-hours support available through site alarms or customer notification. Operations Manager Steve Craig can provide additional information on routine and preventative maintenance schedules.

5. Have there been any significant changes in site O&M requirements, maintenance schedules or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.

   There has been a major well field upgrade – two new wells, auxiliary power for the entire production and treatment process, and updated Supervisory Control and Data Acquisition controls. These add to O&M schedules, but none effect the protectiveness or effectiveness of the remedy. The project sought to increase production, to the treatment level of the remedy.

6. Have there been unexpected O&M difficulties or costs at the Site since start-up or in the last five years? If so, please provide details.

   There have been no unexpected O&M difficulties.

7. Have there been opportunities to optimize O&M activities or sampling efforts? Please describe changes and any resulting or desired cost savings or improved efficiencies.

   The City routinely evaluates processes for costs savings and operational efficiency. Most recently, the upgrades noted in #5 have allowed us to replace less efficient pumps in other wells to save power. Any additional recommendations to improve efficiency or save costs are always welcome.

8. What measures are in place to restrict placement of wells (potable, irrigation, etc.) within the drinking water system's boundaries?

   Our region operates under the Coordinated Water System Plan, adopted by all the regional jurisdictions. This restricts Group A and Group B water systems, as well as exempt wells, within close proximity to the existing water system. Where Group A or B systems are permitted, approvals are given temporarily and they are required to connect when city water reaches their parcel.

9. Do you have any comments, suggestions or recommendations regarding O&M activities and schedules at the Site?

   Public Works Operations has been implementing an effective and functional preventative maintenance program.

10. Do you consent to have your name included along with your responses to this questionnaire in the FYR Report?

    Yes.

Palermo Well Field Ground Water Contamination Superfund Site — Five-Year Review Interview Form

Site Name: Palermo Well Field Ground Water Contamination **EPA ID No.:** WA0000026534

Subject Name: Andrew Smith **Affiliation:** Department of Ecology, State of Washington

Subject Contact Information: Andrew.smith@ecy.wa.gov
Time: 9:47 am **Date:** 05/23/2018
Interview Location: Ecology/Lacey, WA

Interview Format (circle one): In Person Phone Mail Other: Filled out Form

Interview Category: State Agency

1. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   It appears the site is cleaning up as designed. It appears that the environment and the public are being protected.

2. What is your assessment of the current performance of the remedy in place at the Site?

   It appears the contaminant concentrations in the well field wells are below MTCA standards. It appears that the contaminant plume is reducing.

3. Are you aware of any complaints or inquiries regarding site-related environmental issues or remedial activities from residents in the past five years?

   No.

4. Has your office conducted any site-related activities or communications in the past five years? If so, please describe the purpose and results of these activities.

   No.

5. Are you aware of any changes to state laws that might affect the protectiveness of the Site's remedy?

   Ecology is updating its cleanup levels to reflect the new EPA Integrated Risk Information System toxicity values for TCE.

6. Are you comfortable with the status of the institutional controls at the Site? If not, what are the associated outstanding issues?

   Yes

7. Are you aware of any changes in projected land use(s) at the Site?

   No

8. Do you have any comments, suggestions or recommendations regarding the management or operation of the Site's remedy?

No

9. Do you consent to have your name included along with your responses to this questionnaire in the FYR report?

   Yes

Palermo Well Field Ground Water Contamination Superfund Site **Five-Year Review Interview Form**

Site Name: Palermo Well Field Ground Water Contamination **EPA ID No.:** WA0000026534

Interviewer Name: Kay Morrison **Affiliation:** EPA
Subject Name: Resident **Affiliation:** Resident of Palermo neighborhood

Time: 9:30 A.M. **Date:** 03/22/2018
Interview Format: In Person
Interview Category: Resident 1

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date?

   Yes. I have lived here for almost five years and have been told about the history and why they are doing the in-house sampling. I understand the need to collect the data and it is not a big deal to let the sampling happen in my house.

2. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   Before today, I did not know about the water treatment next to the park, but we are aware of when they are doing work in the neighborhood. I have had a good impression.

3. What have been the effects of the Site on the surrounding community, if any?

   No one really talks about the Site. We have a neighborhood Facebook group and it is not mentioned much there. We did have a post on the Facebook page when EPA had the informational event at the park.

4. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing?

   No. This is a safe part of town and I love the neighborhood; I am familiar with most of the residents.

5. Has EPA kept involved parties and surrounding neighbors informed of activities at the Site? How can EPA best provide site-related information in the future?

   We get good communication from WSDOT and GeoEngineers; I get letters that say how the sampling went and I'm not sure I need more information than that. I don't feel like I need information directly from EPA as I feel like I'm getting what I need already. If additional EPA information was shared, it would be best through the neighborhood Facebook page; I wouldn't really look at a website.

6. Do you own a private well in addition to or instead of accessing city/municipal water supplies? If so, for what purpose(s) is your private well used?

   No.

7. Do you have any comments, suggestions or recommendations regarding any aspects of the project?

   No, I think you guys are doing a great job. I get the information I need and everyone has been friendly, nice and respectful.

Palermo Well Field Ground Water Contamination Superfund Site **Five-Year Review Interview Form**

Site Name:	**Palermo Well Field Ground Water Contamination**	**EPA ID No.:**	**WA0000026534**
Interviewer Name:	**Kay Morrison**	**Affiliation:**	**EPA**
Subject Name:	**Nearby Business Employee**	**Affiliation:**	**Affected Business**
Time:	**2:00 P.M.**	**Date:**	**03/22/2018**
Interview Format:	**In Person**		
Interview Category:	**Resident 2**		

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date?

   Yes, the "what" (WSDOT and dry-cleaning waste in the water) was brought to us as a plan to monitor groundwater at depth. That's what I knew first. I got handouts and drawings from EPA (Claire Hong) and it was news to us and we had no idea what was happening at the Site or with the drilling. We got new building owners and I had to try to tell them what was happening at the building to explain the access agreements.

   In September 2017, I received the first notice that they were coming to our parking lot to do drilling. Then we saw tents, hard hats, drills, trucks, etc. The only communication we received was from the vendors because I walked outside and asked them questions. GeoEngineers was very helpful; we would get notice that they were coming to our parking lot. With the drilling machine, my staff had a lot of questions. My records show that aside from the early 2016 information from EPA RPM, we only got information one additional time in September 2017 – which was the "what" but not the "why" drilling and sampling was occurring. The businesses listed in the materials that were to be impacted did not include our building.

   EPA didn't share why this work was happening. I asked for information from EPA to communicate to staff. I was told that EPA couldn't provide information because sampling was incomplete and nothing could be provided in writing because it wasn't yet finalized. Vendors seemed prohibited from providing information (CH2MHill was helpful in trying to obtain information but came back with the same message). We were frustrated we couldn't get answers about why the drilling was happening. We were blasted recently in an employee safety survey because we couldn't get answers to employees about the sampling and drilling. Some worked from home because of concerns about what the drilling potentially meant. We went to the EPA website and it was not up to date, it included scientific jargon, and it felt like something was being hidden. It was not helpful to pull information to potentially share with concerned on-site staff.

   I was provided information from a vendor who shared some statistics that told us what they are monitoring, but what does it mean? I tried to tell people that the tap water was being treated. Except for initial contact from EPA, we have only had contact with the vendors. We tried for phone calls to ask for a couple of paragraphs to share and couldn't get it. It made me feel like I was an inconvenience and made me disconcerted. It reinforced that what EPA is doing is scientific, secretive and dangerous. Every time GeoEngineers was out there with tents and trucks, it struck anxiety with my staff; we thought they were done, and then they would come back again. It's not the inconvenience of the drilling, it is the not knowing why there is drilling.

   I told my executives the vague information I had and shared that I couldn't get good information from EPA, but it is not enough. I believe it is time that EPA updates its website to the current status and emails us, and other impacted business owners, with regular updates.

   Sometimes it feels like we are the tallest, biggest and most-heard building in the area and we should speak up, because the smaller businesses don't have the time or manpower. I have not been sure to who escalate this

issue to. As a neighbor and government office, we should stand up. We have not been updated by EPA since the initial information was shared, which was not well explained. Nobody would argue against this being implemented, but we would like to know why.

We have a budget, attorneys and elected officials. Politics get involved and it's one thing if our staff is unsettled, but it brings up another issue on the insurance side: now who pays for what?

If you look up the Site online, it is scary and I'm surprised it hasn't come out as a bigger public problem. I have been really disappointed with not hearing from EPA about the status, why and if the work is done, what is happening out there now and going forward. Without enough information from EPA, we fill in our own blanks. The vendors have been fantastic. For the internal safety survey, I would like to have a response for concerned staff. I don't have one and it makes me feel helpless.

Let's get better communication going forward. I've been with this agency 25 years and I've earned influence, which I protect. It's hard because I couldn't tell staff anything, but my executive wanted to me to share something, but I couldn't make anything up.

2. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   See above.

3. What have been the effects of the Site on the surrounding community, if any?

   It has made some employees fearful (see above).

4. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing?

   Drilling and sampling mentioned above.

5. Has EPA kept involved parties and surrounding neighbors informed of activities at the Site? How can EPA best provide site-related information in the future?

   No. We want statements in writing to show what is happening. Will this be ongoing? When will it be done? What is the status? We don't need EPA staff here to speak to staff, we just need a couple paragraphs to share with them. It needs to be written without scientific jargon; I'd prefer to not have to rewrite it. It should be something your neighbor or grandmother could read and understand. We are excited to get this. It will be nice to have a response to provide to concerned staff from the employee safety survey. It will be nice to share this progress and we can let executives know that we have a response coming to deal with staff comments. It will be nice to have a qualified response. This information can also be used to update the EPA website to make it current. We would like to know why it is a Superfund site, what the status is, when it will be done, what does it mean, etc.

6. Do you own a private well in addition to or instead of accessing city/municipal water supplies? If so, for what purpose(s) is your private well used?

   No.

7. Do you have any comments, suggestions or recommendations regarding any aspects of the project?

   See above.

Palermo Well Field Ground Water Contamination Superfund Site — Five-Year Review Interview Form

Site Name: Palermo Well Field Ground Water Contamination
EPA ID No.: WA0000026534

Interviewer Name: Kay Morrison
Affiliation: EPA
Subject Name: Resident
Affiliation: Resident of Palermo neighborhood

Time: 3:00 P.M.
Date: 03/22/2018
Interview Format: In Person
Interview Category: Resident 3

1. Are you aware of the former environmental issues at the Site and the cleanup activities that have taken place to date?

   Yes, very much so. Props to everyone involved. Lara Linde is great to work with. Public outreach and education has been great.

2. What is your overall impression of the project, including cleanup, maintenance and reuse activities (as appropriate)?

   Very positive.

3. What have been the effects of the Site on the surrounding community, if any?

   The neighborhood is not very cohesive, but the Site really hasn't been a topic of conversation. I have had some interaction with one neighbor who is a former state employee (I am also a local government employee) and I don't get a sense of a high level of concern. If I were pregnant, I would have more concern. People do not seem frustrated and I haven't heard any concern about home values declining. No news is good news.

4. Have there been any problems with unusual or unexpected activities at the Site, such as emergency response, vandalism or trespassing?

   No, not at all.

5. Has EPA kept involved parties and surrounding neighbors informed of activities at the Site? How can EPA best provide site-related information in the future?

   Yes, I think definitely. It would be great to receive electronic versions of handouts by email after receiving the hard copies. We had a great meeting at the restaurant at the golf course and you've done a great job keeping us informed. We mostly have received handouts at meetings, calls and occasional sampling results. We don't receive emails and maybe more digital outreach would help – email would be great. It is great to receive educational materials in paper format but would be great to get them electronically as well, as a backup. I don't personally use social media but it does work for a lot of people; the younger generation is geared toward social media. I think sharing the information through as many media as possibly is the best way to get it to the most people. We see GeoEngineers in the neighborhood all the time; they are great about reaching out.

6. Do you own a private well in addition to or instead of accessing city/municipal water supplies? If so, for what purpose(s) is your private well used?

Everyone is on city water. I am not aware of any in the neighborhood and I don't have one. Our house had an old septic tank that we filled in when we did a renovation, and it is possible that other houses have those relics as well.

7. Do you have any comments, suggestions or recommendations regarding any aspects of the project?

   I think you guys have really done a good job.

   Request: I know you take water heights and it would be great to share that information with interested residents via a live website, if possible.
   Response: EPA explained the data is not available in real time. But could be something to consider in the future.

   Request: Are any soil boring details of the property available (from when wells were dug) to see the geology of the property?
   Response: EPA will look to see if there are any geological profiles available to share.

APPENDIX E – SITE INSPECTION CHECKLIST

FIVE-YEAR REVIEW SITE INSPECTION CHECKLIST

I. SITE INFORMATION

Site Name: Palermo Well Field Ground Water Contamination	**Date of Inspection:** 3/22/2018
Location and Region: Tumwater, WA 10	**EPA ID: WA0000026534**
Agency, Office or Company Leading the Five-Year Review: Region 10	**Weather/Temperature:** 42 degrees F/rainy

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ☒ Institutional controls
- ☒ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls
- ☒ Other: SVE operated from 1998 to 2000 at the Southgate facility ; subdrain and aeration lagoon, well head treatment at Palermo Well field; and long-term groundwater monitoring.

Attachments: ☐ Inspection team roster attached ☐ Site map attached

II. INTERVIEWS (check all that apply)

1. **O&M Site Manager** Steve Craig (Name) | Operations Manager (Title) | _____ (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
Problems, suggestions ☐ Report attached: _____

2. **O&M Staff** _____ (Name) | _____ (Title) | _____ (Date)
Interviewed ☐ at site ☐ at office ☐ by phone Phone: _____
Problems/suggestions ☐ Report attached: _____

3. **Local Regulatory Authorities and Response Agencies** (i.e., state and tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices). Fill in all that apply.

Agency City of Tumwater
Contact Dan Smith (Name) | Water Resources Program Manager (Title) | 5/8/2018 (Date) | _____ (Phone No.)
Problems/suggestions ☐ Report attached: _____

Agency WSDOT
Contact Norm Payton (Name) | Site Manager (Title) | 4/12/2018 (Date) | 360-705-7848 (Phone No.)
Problems/suggestions ☐ Report attached: _____

Agency _____
Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
Problems/suggestions ☐ Report attached: _____

Agency _____
Contact _____ (Name) | _____ (Title) | _____ (Date) | _____ (Phone No.)
Problems/suggestions ☐ Report attached: _____

Agency _____
Contact _____ _____ _____ _____
Name Title Date Phone No.
Problems/suggestions ☐ Report attached:_____

4. **Other Interviews** (optional) ☐ Report attached: _____

Lara Linde, GeoEngineers, Project Manager (WSDOT Contractor)

Two residents of Palermo neighborhood

Businessman in an office building in the Southgate area

III. ON-SITE DOCUMENTS AND RECORDS VERIFIED (check all that apply)

1. **O&M Documents**

☒ O&M manual	☒ Readily available	☒ Up to date	☐ N/A
☒ As-built drawings	☒ Readily available	☒ Up to date	☐ N/A
☒ Maintenance logs	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

2. **Site-Specific Health and Safety Plan**	☐ Readily available	☐ Up to date	☒ N/A
☐ Contingency plan/emergency response plan	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

3. **O&M and OSHA Training Records**	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

4. **Permits and Service Agreements**

☐ Air discharge permit	☐ Readily available	☐ Up to date	☒ N/A
☒ Effluent discharge	☒ Readily available	☒ Up to date	☐ N/A
☐ Waste disposal, POTW	☐ Readily available	☐ Up to date	☒ N/A
☐ Other permits: _____	☐ Readily available	☐ Up to date	☒ N/A

Remarks: Discharge point of compliance is downgradient of the treatment lagoon before discharging to the Deschutes River.

5. **Gas Generation Records**	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

6. **Settlement Monument Records**	☐ Readily available	☐ Up to date	☒ N/A

Remarks: _____

7. **Groundwater Monitoring Records**	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

8. **Leachate Extraction Records**	☒ Readily available	☒ Up to date	☐ N/A

Remarks: _____

9. **Discharge Compliance Records**

☐ Air	☐ Readily available	☐ Up to date	☒ N/A
☒ Water (effluent)	☒ Readily available	☒ Up to date	☐ N/A

Remarks: Discharge permit required and in place for treatment lagoon but no air permit is required for the air strippers.

10. **Daily Access/Security Logs** ☐ Readily available ☐ Up to date ☒ N/A

Remarks: _____

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for state

☐ PRP in-house ☒ Contractor for PRP

☐ Federal facility in-house ☐ Contractor for Federal facility

☐ _____

2. **O&M Cost Records**

☐ Readily available ☐ Up to date

☐ Funding mechanism/agreement in place ☒ Unavailable

Original O&M cost estimate: _____ ☐ Breakdown attached

Total annual cost by year for review period if available

From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached
From: _____ Date	To: _____ Date	_____ Total cost	☐ Breakdown attached

3. **Unanticipated or Unusually High O&M Costs during Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☒ Applicable ☐ N/A

A. Fencing

1. **Fencing Damaged** ☐ Location shown on site map ☒ Gates secured ☐ N/A

Remarks: Fencing around treatment lagoon and Palermo Well field; fencing in good condition.

B. Other Access Restrictions

1. **Signs and Other Security Measures** ☐ Location shown on site map ☒ N/A

Remarks: _____

C. Institutional Controls (ICs)

1. **Implementation and Enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ☒ No ☐ N/A

Site conditions imply ICs not being fully enforced ☐ Yes ☒ No ☐ N/A

Type of monitoring (e.g., self-reporting, drive by): _____

Frequency: _____

Responsible party/agency: _____

Contact _____ _____ _____ _____

Name Title Date Phone no.

Reporting is up to date ☐ Yes ☐ No ☒ N/A

Reports are verified by the lead agency ☐ Yes ☐ No ☒ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☒ No ☐ N/A

Violations have been reported ☐ Yes ☐ No ☒ N/A

Other problems or suggestions: ☐ Report attached

2. **Adequacy** ☐ ICs are adequate ☒ ICs are inadequate ☐ N/A

Remarks: Currently, no institutional control is recorded for the Southgate Dry Cleaners. However, the land use has not changed since the ROD.

D. General

1. **Vandalism/Trespassing** ☐ Location shown on site map ☒ No vandalism evident

Remarks: _____

2. **Land Use Changes On Site** ☒ N/A

Remarks: _____

3. **Land Use Changes Off Site** ☒ N/A

Remarks: _____

VI. GENERAL SITE CONDITIONS

A. Roads ☒ Applicable ☐ N/A

1. **Roads Damaged** ☐ Location shown on site map ☒ Roads adequate ☐ N/A

Remarks: _____

B. Other Site Conditions

Remarks: _____

VII. LANDFILL COVERS ☐ Applicable ☒ N/A

VIII. VERTICAL BARRIER WALLS ☐ Applicable ☒ N/A

IX. GROUNDWATER/SURFACE WATER REMEDIES ☒ Applicable ☐ N/A

A. Groundwater Extraction Wells, Pumps and Pipelines ☐ Applicable ☒ N/A

1. **Pumps, Wellhead Plumbing and Electrical**

☐ Good condition ☐ All required wells properly operating ☐ Needs maintenance ☐ N/A

Remarks: _____

2. **Extraction System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

B. Surface Water Collection Structures, Pumps and Pipelines ☐ Applicable ☒ N/A

1. **Collection Structures, Pumps and Electrical**

☐ Good condition ☐ Needs maintenance

Remarks: _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes and Other Appurtenances**

☐ Good condition ☐ Needs maintenance

Remarks: _____

3. **Spare Parts and Equipment**

☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided

Remarks: _____

C. Treatment System ☒ Applicable ☐ N/A

1. **Treatment Train** (check components that apply)

☐ Metals removal ☐ Oil/water separation ☐ Bioremediation

☒ Air stripping ☐ Carbon adsorbers

☒ Filters: Air used by air strippers is filtered.

☒ Additive (e.g., chelation agent, flocculent): Disinfection.

☒ Others: Acid used to strip build-up of chlorite from media in the strippers.

☒ Good condition ☐ Needs maintenance

☒ Sampling ports properly marked and functional

☒ Sampling/maintenance log displayed and up to date

☒ Equipment properly identified

☐ Quantity of groundwater treated annually: _____

☐ Quantity of surface water treated annually: _____

Remarks: Treatment lagoon operates aerators to treat groundwater collected by the subdrain.

2. **Electrical Enclosures and Panels** (properly rated and functional)

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

3. **Tanks, Vaults, Storage Vessels**

☐ N/A ☒ Good condition ☐ Proper secondary containment ☐ Needs maintenance

Remarks: _____

4. **Discharge Structure and Appurtenances**

☐ N/A ☒ Good condition ☐ Needs maintenance

Remarks: _____

5. **Treatment Building(s)**

☐ N/A ☒ Good condition (esp. roof and doorways) ☐ Needs repair

☒ Chemicals and equipment properly stored

Remarks: _____

6. **Monitoring Wells** (pump and treatment remedy)

☒ Properly secured/locked ☒ Functioning ☒ Routinely sampled ☒ Good condition

☒ All required wells located ☐ Needs maintenance ☐ N/A

Remarks: _____

D. Monitoring Data

1. **Monitoring Data**

☒ Is routinely submitted on time ☒ Is of acceptable quality

2. **Monitoring Data Suggests:**

☐ Groundwater plume is effectively contained ☐ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)

☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition

☐ All required wells located ☐ Needs maintenance ☒ N/A

Remarks: _____

X. OTHER REMEDIES

If there are remedies applied at the site and not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is designed to accomplish (e.g., to contain contaminant plume, minimize infiltration and gas emissions).

The remedy included continuing the operation of the wellhead treatment system (using air stripping) at the Palermo Well field and the SVE system at the Southgate area installed as early actions. The remedy also included the construction of a subdrain system in the Palermo neighborhood to lower the groundwater water table 18 inches below the residential crawl spaces; construction of an aeration lagoon to treat groundwater collected from the subdrain and discharge to the Deschutes River; long-term groundwater monitoring and monitoring of the discharge from the aeration lagoon; and institutional controls (notification of groundwater contamination and institutional controls on the Southgate area to reduce leaching of soil contamination to groundwater).

Groundwater concentrations show a general decline since remediation started; however, the concentrations of PCE and TCE remain above ROD remedial goals. In addition, delineation of the TCE and PCE plumes is ongoing at the CMTL (TCE) and at the Southgate area (PCE and TCE). Further, the subdrain does not capture all of the shallow groundwater, resulting in some exceedances of vapor intrusion risk at one home due to contaminated groundwater surfacing under the crawl space and affecting indoor air. Current data suggest that there may be more sourcing occurring from soil to groundwater at the Southgate area.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

O&M activities are conducted to maintain the wellhead treatment system, subdrain system and aeration lagoon. No issues were identified with the current O&M activities.
C. Early Indicators of Potential Remedy Problems
Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs that suggest that the protectiveness of the remedy may be compromised in the future. The city well field does not pump at high enough rates to contain the plume. Also, the subdrain system has been successful in achieving performance criteria required by the ROD in the central portion of Rainier Avenue but not at its south end or, occasionally, at the north end of the street due to artesian conditions.
D. Opportunities for Optimization
Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. WSDOT and EPA are currently filling data gaps to support the evaluation of addition remedies to address contamination that remains above ROD remedial goals.

APPENDIX F – SITE INSPECTION PHOTOS

Palermo well field drinking water system treatment building

Palermo well field well houses

Air strippers inside the drinking water treatment building

Palermo Park, with drinking water well field and treatment building in the background


Wetlands to the east of the Palermo well field

Treatment lagoon and aeration units with golf course in the background

DG-15 and DG-16 located on SE Palermo Ave in the Palermo neighborhood

MW-DG-05 near CMTL building

Dry cleaner at the Southgate Mall

The CMTL

The Mobil gas station, location of the FMTL

Drainage ditch area behind house near the subdrain area off M Street

APPENDIX G – DETAILED DATA ANALYSIS

This appendix details contaminant trends for the last five years to evaluate remedy performance. Figure G-1 is a Site plan showing production wells and monitoring well locations.

Wellhead Treatment System

For this FYR period, four of the six city production wells were sampled on a semi-annual basis (TW-4, TW-5, TW-8 and TW-16). TW-5 was decommissioned in January 2014 due to scale build-up; data are available through 2013 for this well. TW-3 is inactive due to its lower pump rate and was not sampled during this FYR period. The number of production wells used for production varies depending on demand. TW-17 was installed in 2012 but has not been operating. PCE concentrations in production well samples have been below laboratory detection limits (0.2 µg/L) throughout the review period. TCE has been detected in TW-4 and TW-16 before treatment; concentrations in TW-16 exceeded the ROD remedial goal (5 µg/L) during each sampling event since it was installed in 2014 (Table G-1). The City runs the treatment system using air stripper towers (ST-1 or ST-2). Air stripping effectively removes TCE and PCE from groundwater; air stripper effluent samples are consistently below laboratory detection limits. This demonstrates that the wellhead treatment system effectively eliminates PCE and TCE contamination from groundwater before distribution.

Table G-1: Summary of TCE Detections in Production Wells Prior to Treatment

Production Well	TCE Concentrations (µg/L)[a]	
	TW-4	TW-16
September 2013	1.3	-
April 2014	0.43	**9.6**
August 2014	0.89	**19**
March 2015	<0.2	**10**
September 2015	0.89	**18**
April 2016	NA	NA
August 2016	0.6	NA
March 2017[b]	<0.2	**7.1**
August/Sept 2017[b]	<0.2	**7.8**

Notes:

a. Detailed results for all wells can be locatedin the following reports:
2013 through 2015: 2016 Semiannual Groundwater Monitoring Report, Table 3.
2016: 2016 Annual Groundwater Monitoring Report, Table B-5.
2017: Draft 2017 Annual Groundwater Monitoring Report, Table 2.

\- = well installed in 2012 and monitoring began in 2014.

NA = the City was performing upgrades to the treatment system so no samples were collected from TW-4 and TW-16.

Bold = sample exceeds remedial goal of 5 µg/L.

Well Field Capture Zone

As part of evaluating the nature and extent of volatile organic compound contamination in Site groundwater, WSDOT presented an updated capture zone analysis in the draft DGR and the draft 2017 Annual Groundwater Monitoring reports issued in 2018. Although EPA continues to review these reports, they concluded that the TCE plume would not be entirely captured at the current average usage rates. An updated capture zone analysis indicated that the full targeted capture zone could be obtained by pumping the active wellfield wells continuously at a maximum, though unlikely sustainable rate. The well field operator is not contractually obligated to continually operate the well field to ensure complete plume capture. EPA and WSDOT will re-evaluate the well field capture zone using data collected for the supplemental RI/FS.

Plume Delineation and Long-Term Monitoring Adequacy
Since long-term monitoring began in 2004, PCE and TCE concentrations in groundwater have gradually decreased in most wells where these COCs were detected as illustrated in the 2016 and 2017 annual groundwater monitoring reports (GeoEngineering, 2016; 2017). WSDOT conducted statistical trend analyses where PCE or TCE has been detected. The analysis shows a statistically significant decreasing trend in PCE and TCE concentrations in most wells, piezometers, and production well TW-4 (Table G-2).

Table G-2: Summary of Contaminant Concentration Trends in Groundwater (2004 through 2016)

Location ID	Total Number of VOC Samples Collected*	PCE Maximum Concentration Detected* (µg/L)/Date	General Long Term PCE Concentration Statistical Trend (95 Percent Confidence Limit)	TCE Maximum Concentration Detected* (µg/L)/ Date	General Long Term TCE Concentration Statistical Trend (95 Percent Confidence Limit)
MW-101B	21	0.1 / Mar 2006	Decreasing	17 / Apr 2009	Decreasing
MW-104A	11	ND	Decreasing	11 / Oct 2006	Decreasing
MW-104B	25	2.4 / Nov 2007	Decreasing	0.26 / May 2004	Decreasing
MW-109	25	ND	Not Detected	32 / Sep 2004	Decreasing
MW-110	25	ND	Not Detected	ND	Not Detected
MW-111	25	ND	Not Detected	22 / May 2004	Decreasing
MW-UI	25	ND	Not Detected	28 / Nov 2007	Decreasing
MW-ES-02	21	ND	Not Detected	68 / Nov 2006	Decreasing
MW-ES-03	24	0.13 / Oct 2005	Decreasing	42 / Sep 2004	Decreasing
MW-ES-04	24	58 / May 2004	Decreasing	1.8 / May 2008	Decreasing
MW-ES-05	25	0.21 / May 2008	Decreasing	58 / May 2008	Decreasing
MW-ES-06	25	49 / Jun 2007	No Statistically Significant Trend	16 / Mar 2006	Decreasing
MW-ES-07	21	0.1 / Mar 2006	Decreasing	11 / Nov 2007	Decreasing
MW-ES-09	25	ND	Not Detected	300 / Apr 2005	Decreasing
MW-ES-10	25	ND	Not Detected	83 / Sep 2004	Decreasing
PZ-719	10	ND	Not Detected	2.5 / Sep 2016	Increasing
PZ-720	11	1.1 / Dec 2004	No Statistically Significant Trend	18 / Aug 2015	No Statistically Significant Trend
PZ-721	23	0.79 / Dec 2004	Decreasing	98 / Dec 2004	No Statistically Significant Trend
PZ-724	23	0.45 / Dec 2004	Decreasing	87 / May 2008	No Statistically Significant Trend
PZ-725	11	ND	Not Detected	0.35 / Dec 2004	No Statistically Significant Trend
PZ-726	11	ND	Not Detected	3.9 / Sep 2016	Increasing
PZ-728	23	ND	Not Detected	51 / Oct 2008	Decreasing
RPZ-731	10	ND	Not Detected	2.8 / Sep 2016	Increasing
TW-4	20	ND	Not Detected	3.4 / Mar 2006	Decreasing

Notes:
*Since long term monitoring began in 2004.
ND = Compound not detected.
Source: 2016 Annual Groundwater Monitoring Report. Prepared by GeoEngineers, Inc.

Previous FYRs and EPA's 2011 Optimization Evaluation indicated uncertainty whether the existing monitoring network is adequate for plume characterization and delineation. WSDOT has improved delineation and characterization of the contaminant plumes; however, based on the data presented in the draft DGR, several localized areas still need further delineation. The current general plume map for TCE and PCE from the 2016 Annual Groundwater Monitoring Report shows that the PCE/TCE plume is discontinuous in two areas on the west side of Interstate 5. (Figure G-3). The shaded area of the plume map represents the overall area of detected PCE and TCE at the Site. A larger area of TCE extends through the Southgate area into the Palermo neighborhood. WSDOT is sampling to further delineate the TCE plume near MW-111 near the CMTL facility. EPA is performing a supplemental PCE investigation at the Southgate area to delineate the PCE plume and better understand its interaction with the TCE plume in this area. WSDOT is preparing a supplemental RI/FS. Once the supplemental investigations are complete, updated plume dimensions and characteristics will be incorporated into the RI/FS and an updated long-term groundwater monitoring program.

Subdrain System and Treatment Lagoon
The subdrain, which consists of a perforated pipe about 8 feet below ground surface, collects shallow groundwater ponding in backyards and crawl spaces behind the seven southernmost houses west of SE Rainier Avenue (Figure G-4). Groundwater that enters the perforated pipe flows to an unperforated "tightline" pipe

beneath SE Rainier Avenue and SE M Street, then drains to the treatment lagoon at the Municipal Golf Course. Water samples are collected from three subdrain cleanout locations (stations 357, 358 and 359) and four discharge locations to the treatment lagoon (350, 356, 360 and 362) (Figure G-4). Treatment lagoon effluent (Station 361) and the Deschutes River outfall location (Station 364), located about 2,000 feet downstream of the treatment lagoon, are also sampled by WSDOT (Figure G-4). As shown in Table G-3, PCE and TCE concentrations are reduced below the remedial goal as contaminated groundwater from the subdrain system and is treated by aeration in the treatment lagoon.

Although the treatment lagoon meets performance criteria, the subdrain system may not be capturing all contaminated groundwater as reported in the SEIR and the draft DGR. These reports indicate that the subdrain system has achieved ROD performance criteria in the central portion of Rainier Avenue, but not at its south end or, sometimes, at the north end of the street due to artesian conditions. These reports imply that the subdrain is not effectively eliminating surface seeps along the base of the bluff as anticipated. WSDOT is preparing a supplemental RI/FS that will identify additional remedies to address this concern.

Table G-3: Summary of Subdrain System and Treatment Lagoon Data (2014 through 2017)

Location	PCE (µg/L)								TCE (µg/L)							
	Spring 2014	**Summer 2014**	**Spring 2015**	**Summer 2015**	**Spring 2016**	**Fall 2016**	**Spring 2017**	**Fall 2017**	**Spring 2014**	**Summer 2014**	**Spring 2015**	**Summer 2015**	**Spring 2016**	**Fall 2016**	**Spring 2017**	**Fall 2017**
Subdrain Cleanouts																
357-Cleanout CO-6	**10**	**12**	**11**	**11**	**10**	**11**	**9.2**	**9.8**	**8.4**	**6.0**	**7**	**6.5**	**7.9**	**6.0**	**11**	**8.0**
358-Cleanout CO-4	**7.0**	**8.0**	**8.1**	**8.0**	**7.0**	**7.3**	**6.0**	**5.0**	**15**	**14**	**14**	**14**	**14**	**14**	**14**	**17**
359-Cleanout CO-1	**4.6**	**4.3**	**4.2**	**4.6**	**4.4**	**4.0**	**3.9**	**4.4**	**12**	**10**	**10**	**11**	**10**	**11**	**10**	**11**
Outfalls to Treatment Lagoon																
350-M Street Drain Outfall	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	1.2	1.0	1.2	1.4	1.3	1.5	1.2	0.37
356-Inflow from Upstream Wetlands	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.23	0.2U	0.2U	0.2U	0.2U	0.2U
360-Tightline Outfall	**4.0**	**4.4**	**3.5**	**3.9**	**4.1**	**3.3**	**3.3**	**4.0**	**11**	**11**	**8.6**	**9.7**	**9.6**	**9.6**	**9.0**	**10**
362-M Street Terminus Catch Basin Outfall	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Treatment Lagoon Effluent																
361-Lagoon Effluent	0.3	0.3	0.24	0.27	0.26	0.20	0.24	0.39	0.95	0.82	0.76	0.86	0.73	0.66	0.81	1.1
Deschutes River Outfall																
364-Point of Compliance*	0.2U	0.2	0.2U	0.2U	0.2U	0.2U	0.2U	0.2U	0.5	0.5	0.2U	0.37	0.41	0.42	0.2U	0.38
Deschutes River Discharge Remedial Goal	0.8								2.7							

Notes:
* = ROD remedial goals for the point of compliance for PCE and TCE are 0.8 µg/L and 2.7 µg/L, respectively.
Bold = concentrations of PCE or TCE that exceed the point of compliance discharge remedial goal. The remedial goal applies only at the outfall to the Deschutes River; however, the bolded values are shown to highlight that concentrations are declining as PCE and TCE are treated in the lagoon.
U = below detection.
NS = not sampled.

Soil Vapor Extraction System at Southgate Dry Cleaners

An SVE system operated from 1998 to 2000; it was decommissioned in 2000 when the average soil concentration met the ROD remedial goal for PCE in soil. However, a confirmation sample collected after decommissioning contained 0.232 mg/kg PCE, which exceeds the ROD remedial goal of 0.0858 mg/kg. EPA conducted a supplemental investigation in October and November 2017; PCE concentrations in soil ranged from below detection to 2.2 mg/kg (at SB-01) at the Southgate area. Samples SB-01 through SB-04 were collected under the building slab. Samples SB-05 through SB-08 were collected in the parking lot in front of the Southgate Dry Cleaner building. As shown in Table G-4, PCE was detected in seven of eight soil boring samples at concentrations above the ROD remedial goal based on leaching to groundwater. The highest concentrations are in SB-01 (2.2 mg/kg), which is the location of the former drywell where PCE was disposed. These results indicate that soils in this area are potentially a continuing source to groundwater. The PCE detections do not appear to pose a residential direct contact concern as the maximum concentration of 2.2. mg/kg is below EPA's 2017 RSL of 24 mg/kg k) and the noncancer-based RSL of 81 mg/kg (based on an HQ of 1). These soils also are located beneath a paved parking lot.

Table G-4: Summary of PCE Concentrations Detected in Soil at the Southgate Drycleaners Area (2017)

Sample	Feet (bgs)	Sample Date	PCE (mg/kg)
SB-01	5	11/05/17	**2.2**
	11	11/05/17	**1.9**
	14	11/05/17	**0.240**
SB-02	3	11/05/17	**0.770**
	10	11/05/17	**1.6**
	12.5	11/05/17	**1.1**
SB-03	8	11/05/17	**1.4**
	9	11/05/17	**0.860**
	14	11/05/17	**1.0**
SB-04	8	11/05/17	**0.520**
	11	11/05/17	**0.650**
	14	11/05/17	**1.1**
SB-05	13	10/17/17	**0.140**
	18	10/17/17	0.0015U
	33	10/17/17	0.0063
SB-06	14	10/20/17	**0.300**
	17	10/20/17	**0.150**
	19	10/20/17	**0.160**
	28	10/20/17	0.020
	34	10/20/17	0.015
SB-07	13	10/19/17	**0.360**
	16	10/19/17	**0.220**
	22	10/19/17	0.0035
	26	10/19/17	0.034
	36	10/19/17	0.034
SB-08	9	10/23/17	0.0091
	18	10/23/17	0.025
	28	10/23/17	0.016J
	33	10/23/17	0.0095

Notes:
J = the identification of the analyte is acceptable; the reported value is an estimate.
Bold = sample exceeds the ROD remedial goal of 0.0858 mg/kg.

Soil Vapor and Indoor Air

EPA selected groundwater remedies to address the RAO of preventing inhalation of COC vapors from residential crawl spaces at concentrations that result in a total excess cancer risk of greater than 1 x 10^{-6}. WSDOT completed a screening-level evaluation of vapor intrusion risks in the SEIR for the three commercial areas (FMTL, CMTL and Southgate) using indoor air concentrations modeled from groundwater data collected in 2012. WSDOT also evaluated vapor risks in the Palermo neighborhood using indoor air and crawl space data collected from 2013 through 2017.

Commercial Areas

As shown in Table G-5, the conservative vapor intrusion screen using groundwater data demonstrated that commercial/industrial cancer risks for the FMTL and CMTL were less than 1 x 10^{-6} and less than the noncancer HI of 1. Results from the Southgate area indicate that using the maximum from shallow or deep wells results in maximum cancer risk of 4 x 10^{-6} and maximum HI of 1 due to TCE in deep well MW-ES-02. According to the draft DGR, if shallow wells at this area are used, groundwater concentrations are below the commercial vapor intrusion screening levels. To confirm results of the shallow groundwater data, EPA and WSDOT are in the process of planning for additional vapor intrusion evaluation at the Southgate area using multiple lines of evidence.

WSDOT conducted a future residential risk evaluation at the three commercial areas (FMTL, CMTL and Southgate) in the SEIR. Residential risks at all three areas exceed the risk level of 1 x 10^{-6} or the noncancer HI of 1 (Table G-5) Although use of the areas is anticipated to remain commercial, additional vapor intrusion evaluation is needed at the day care facility near the CMTL to further evaluate this pathway. Additional vapor intrusion evaluation is needed at the Southgate area to verify that shallow groundwater does not pose unacceptable risks to building occupants.

The screening-level vapor risks included in the SEIR were based on 2012 data. September 2017 PCE and TCE concentrations in these wells are slightly lower than 2012 concentrations used in the SEIR. Therefore, potential risks and hazards in this area from vapor intrusion would be slightly lower than observed in 2012.

Table G-5: Summary of Maximum Screening-Level Vapor Risk Based on 2012 Well Data

Area	Groundwater Concentration (µg/L)	Occupational[a]		Future Residential[a]	
		Cancer Risk	Noncancer HI	Cancer Risk	Noncancer HI
FMTL	Well 109 PCE - 0.5U/0.2U TCE – 13/12	1 x 10^{-6}	0.4	**9 x 10^{-6}**	**3**
CMTL	Well 111 PCE - 0.5U/0.2U TCE – 12/6.3	9 x 10^{-7}	0.3	**8 x 10^{-6}**	**3** **(**only at MW-111)
Southgate	Well MW-ES-02 PCE – 0.5U/0.2U TCE – 47/35	**4 x 10^{-6}** (4 x 10^{-7})[b]	1 (0.032)[b]	**3 x 10^{-5}**	**12**

Notes:

a. Occupational and residential results as presented in Table 5-9 and Table 5-10 of the 2017 SEIR, respectively.

b. Using only the maximum shallow well concentrations (MW-ES-06), the risk and HI are lower.

Bold = cancer risk exceeds the ROD target risk level of 1 x 10^{-6} or the noncancer HI of 1.

/ = value is the September 2017 concentration as presented in Table 2 of the Draft 2017 Annual Groundwater Monitoring Report.

Palermo Neighborhood

Eight rounds of air monitoring took place in the Palermo neighborhood between spring 2013 and fall 2017. Not until winter 2017 was TCE detected in indoor air (4.4 µg/m^3) and crawl space air (3.7 µg/m^3) at concentrations above the ROD remedial goal of 1.46 µg/m^3 and the short-term exposure screening level of 2.0 µg/m^3; this occurred in only one home (Table G-6). This home was resampled in spring 2017 and the TCE indoor air

concentration (1.8 µg/m^3) was above the remedial goal but lower than the short-term exposure advisory level; crawl space air (0.85 µg/m^3) was below the remedial goal and short-term advisory level. WSDOT offered to install an EPA-approved vapor intrusion mitigation system after the spring 2017 sampling, but the homeowner declined. This home was resampled in fall 2017; TCE was detected above the ROD remedial goal of 1.46 µg/m^3 and the short-term exposure advisory level of 2.0 µg/m^3 in the air (4.2 µg/m^3) and crawl space (4.8 µg/m^3) samples. After the fall 2017 results, EPA and WSDOT tried to contact the homeowners in December 2017 and January 2018 by various methods, including phone calls and a certified mail letter with a summary of the fall 2017 results; in the letter, WSDOT again offered to install a vapor intrusion mitigation system. The homeowners have not responded to these inquiries.

PCE was detected in indoor air of four other homes at concentrations above the remedial goal of 4.38 µg/m^3. WSDOT and EPA determined that PCE detected in these homes is likely attributable to indoor sources such as dry-cleaned clothing, scented candles, air fresheners, craft supplies or other household solvents based on crawl space air data, soil vapor data, shallow groundwater data and a home building survey.

Table G-6: Residential Indoor Data (2013 to 2017)

Home Samples

Sample Location	Sample Event	TCE[1]		PCE[1]	
		Indoor	Crawlspace	Indoor	Crawlspace
		µg/m³			
HN 43	Spring 2013	No samples collected (declined to participate)			
	Fall 2013	No samples collected (home being remodeled)			
	Winter 2014	0.048 U	0.048 U	0.056 U	0.056 U
	Summer 2014	**0.13**	**0.16**	**0.27**	**0.36**
	Summer 2015	0.048 U	0.048 U	**0.080**	**0.14**
	Spring 2016	0.048 U	0.048 U	0.056 U	**0.11**
	Winter 2017	0.048 U	0.048 U	**0.073**	0.056 U
HN 1	Spring 2013	0.048 U	0.048 U	**0.23**	**0.14**
	Fall 2013	0.048 U	0.048 U	**0.27**	**0.17**
	Winter 2014	No samples collected (declined to participate)			
	Summer 2014	No samples collected (declined to participate)			
	Summer 2015	Neighborhood Zone 1 Home - No samples collected (declined to participate)			
	Spring 2016	Neighborhood Zone 1 Home - No samples collected (declined to participate)			
	Winter 2017	0.048 U	0.048 U	**0.1**	**0.12**
HN 21	Spring 2013	**0.15**	**0.24**	**0.65**	0.056 U
	Fall 2013	No samples collected (unable to schedule)			
	Winter 2014	**0.46**	n/a***	**0.44**	n/a***
	Summer 2014	No samples collected (declined to participate)			
	Summer 2015	Neighborhood Zone 1 Home - No samples collected (declined to participate)			
	Spring 2016	Neighborhood Zone 1 Home - No samples collected (declined to participate)			
	Winter 2017 (March)	**4.4**	**3.7**	**0.35**	**0.067**
	Winter 2017 (May)	**1.8**	**0.85**	**0.45**	**0.058**
HN 12	Spring 2013	No samples collected (declined to participate)			
	Fall 2013	No samples collected (declined to participate)			
	Winter 2014	**0.20**	**0.22**	0.049 U	0.049 U
	Summer 2014	**0.18**	**0.79**	0.047 U	0.047 U
	Summer 2015	Neighborhood Zone 1 Home - No samples collected (declined to participate)			
	Spring 2016	**0.19**	**0.30**	**0.18**	**0.059**
	Winter 2017	**0.19**	**0.19**	0.056 U	0.056 U
HN 44	Spring 2013	0.044 U	0.044 U	**0.064**	0.052 U
	Fall 2013	0.048 U	0.048 U	**0.19**	**0.081**
	Winter 2014	0.048 U	0.048 U	0.056 U	0.056 U
	Summer 2014	0.044 U	0.044 U	0.051 U	0.051 U
	Summer 2015	0.048 U	**0.054**	0.057 U	0.057 U
	Spring 2016	0.048 U	0.048 U	0.056 U	0.056 U
	Winter 2017	0.048 U	0.048 U	0.056 U	0.056 U
HN 46	Spring 2013	**0.053**	**0.049**	**2.0**	0.053 U
	Fall 2013	No samples collected (declined to participate)			
	Winter 2014	**0.059**	**0.052**	**0.28**	0.047 U
	Summer 2014	No samples collected (declined to participate)			
	Summer 2015	Neighborhood Zone 1 Home - No samples collected (declined to participate)			
	Spring 2016	Neighborhood Zone 1 Home - No samples collected (declined to participate)			
	Winter 2017	0.050 U	0.050 U	**0.061**	0.058 U
HN 9	Spring 2013	No samples collected (declined to participate)			
	Fall 2013	**0.35**	**0.58**	**0.12**	**0.099**
	Winter 2014	No samples collected (declined to participate)			
	Summer 2014	No samples collected (declined to participate)			
	Summer 2015	Neighborhood Zone 1 Home - No samples collected (declined to participate)			
	Spring 2016	Neighborhood Zone 1 Home - No samples collected (declined to participate)			
	Winter 2017	**0.12**	**0.15**	**0.082**	0.054 U
HN 2	Spring 2013	No samples collected (declined to participate)			
	Fall 2013	No samples collected (declined to participate)			
	Winter 2014	**0.060**	**0.12**	**0.062**	0.049 U
	Summer 2014	**0.094**	**0.53**	0.054 U	0.054 U
	Summer 2015	**0.11**	**0.62**	0.056 U	0.056 U
	Spring 2016	0.050 U	**0.16**	**0.077**	0.058 U
	Winter 2017	0.048 U	**0.066**	**0.19**	0.056 U
HN 22	Winter 2017	0.047 U	0.047 U	0.055 U	0.055 U

Ambient Samples

Sample Location	Sample Event	TCE[1]	PCE[1]
		µg/m³	
South end Rainier Avenue	Spring 2013	0.046 U	0.054 U
	Fall 2013	0.044 U	**0.12**
	Winter 2014	0.045 U (3) 0.044 U (3)	0.053 U (3) 0.051 U (3)
	Summer 2014	0.046 U (3) 0.046 U (3)	0.053 U (3) 0.054 U (3)
	Summer 2015	0.045 U	0.053 U
	Spring 2016	0.046 U	0.053 U
	Winter 2017	0.045 U	0.053 U

Sample Location	Sample Event	TCE[1]		PCE[1]	
		Indoor	Crawlspace	Indoor	Crawlspace
		µg/m^3			
North end Rainier Avenue	Spring 2013	0.046 U		**0.056**	
	Fall 2013	0.044 U		**0.059**	
	Winter 2014	0.045 U (3) 0.044 U (3)		0.053 U (3) 0.051 U (3)	
	Summer 2014	0.046 U (3) 0.046 U (3)		0.053 U (3) **0.065 (3)**	
	Summer 2015	0.045 U		0.053 U	
	Spring 2016	0.046 U		0.053 U	
	Winter 2017	0.045 U		0.053 U	
South end Palermo Avenue	Spring 2013	0.046 U		0.054 U	
	Fall 2013	0.044 U		**0.062**	
	Winter 2014	0.045 U (3) 0.044 U (3)		0.053 U (3) 0.051 U (3)	
	Summer 2014	0.046 U (3) 0.046 U (3)		0.053 U (3) 0.054 U (3)	
	Summer 2015	0.045 U		0.053 U	
	Spring 2016	0.046 U		0.053 U	
	Winter 2017	No samples analyzed (samplers were missing on the day they were to be retrieved)			
North end Palermo Avenue	Spring 2013	0.046 U		0.054 U	
	Fall 2013	0.044 U		**0.068**	
	Winter 2014	0.045 U (3) 0.044 U (3)		0.053 U (3) 0.051 U (3)	
	Summer 2014	0.046 U (3) 0.046 U (3)		0.053 U (3) 0.054 U (3)	
	Summer 2015	0.045 U		0.053 U	
	Spring 2016	0.046 U		0.053 U	
	Winter 2017	0.045 U		0.053 U	
East end N Street	Spring 2013	0.046 U		**0.055**	
	Fall 2013	0.044 U		0.051 U	
	Winter 2014	0.045 U (3) 0.044 U (3)		0.053 U (3) 0.051 U (3)	
	Summer 2014	0.046 U (3) 0.046 U (3)		0.053 U (3) 0.054 U (3)	
	Summer 2015	0.045 U		0.053 U	
	Spring 2016	0.046 U		0.053 U	
	Winter 2017	**0.057**		0.053 U	

Notes:

[1] 1999 ROD Indoor Air Cleanup Goals (EPA 1999): TCE = 1.46 µg/m^3 and PCE = 4.38 µg/m^3.

Shaded blue cell indicate the Winter and Spring 2017 sampling event location and analytical results.

Shaded orange cell indicates TCE exceeded the ROD Indoor Air Cleanup Goal.

HN = House Number

U = The compound was not detected at a concentration greater than the reporting limit.

J = Estimated concentration

n/a = not applicable

EPA = Environmental Protection Agency

ROD = 1999 Record of Decision

(1) = Primary sample location

(2) = Secondary sample location

(3) = Samples collected over different time periods

µg/m^3 = microgram per cubic meter

b = Indoor air sample collected in the basement of this home

sv = Sub slab soil vapor sample was collected using a 6-Liter Summa Canister with a 30-minute flow controller

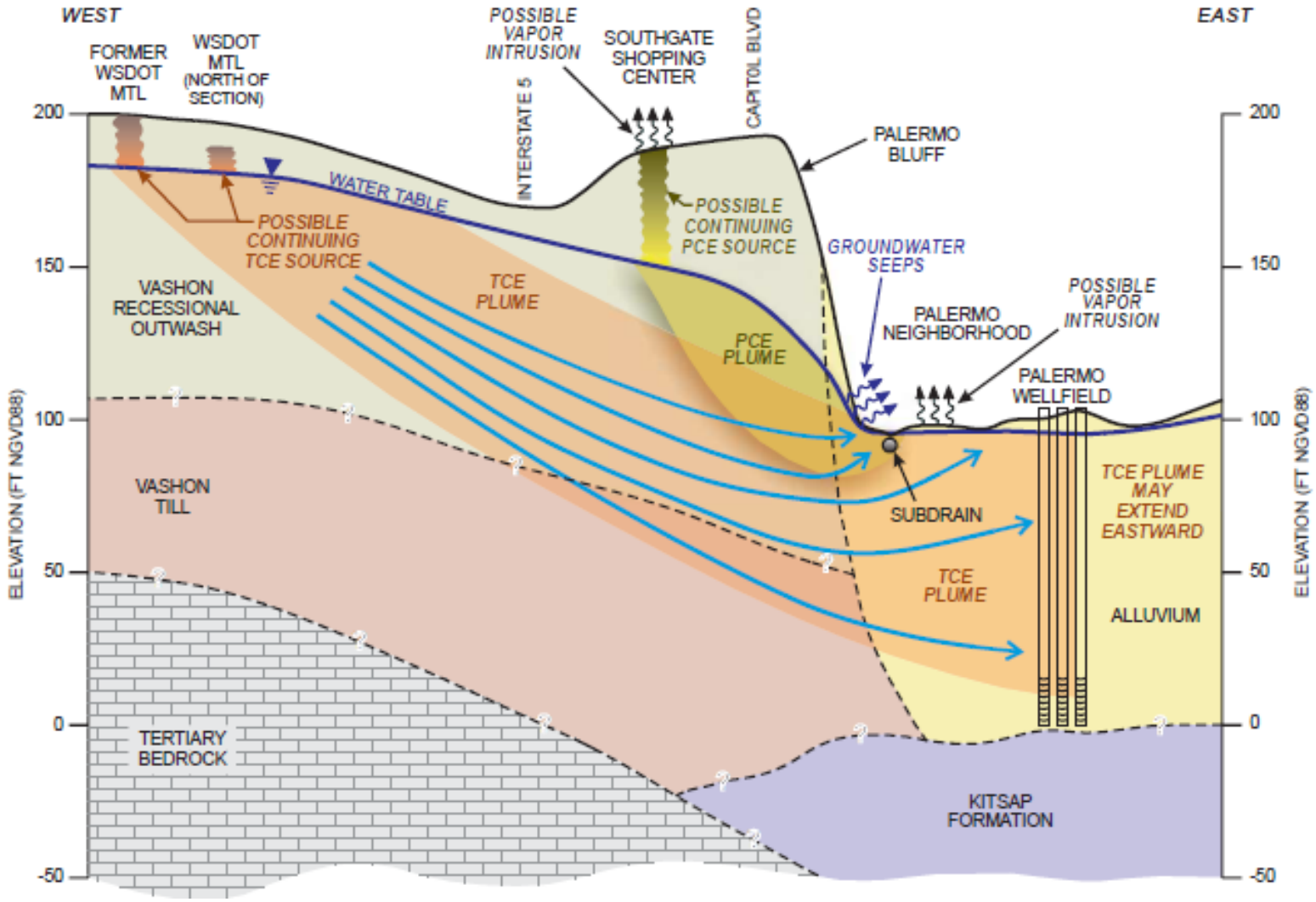
* = Crawl space not accessible

** = Slab-on-Grade/No Crawl Space. No soil vapor (sv) sample collected

*** = Unable to retrieve deployed sampler

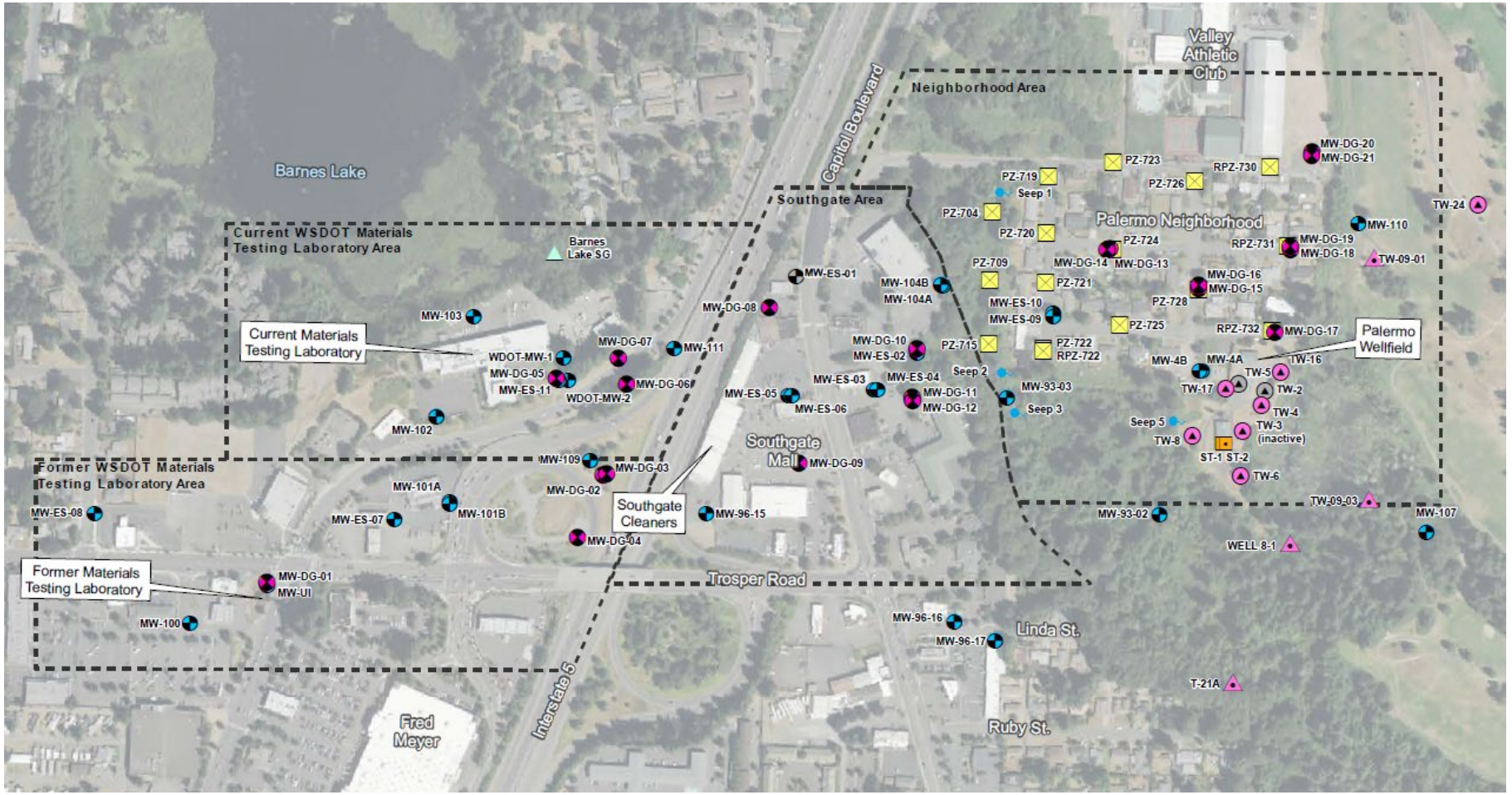
Bold Type indicates the compound was detected at a concentration greater than the reporting limit.

Figure G-1: Conceptual Site Model



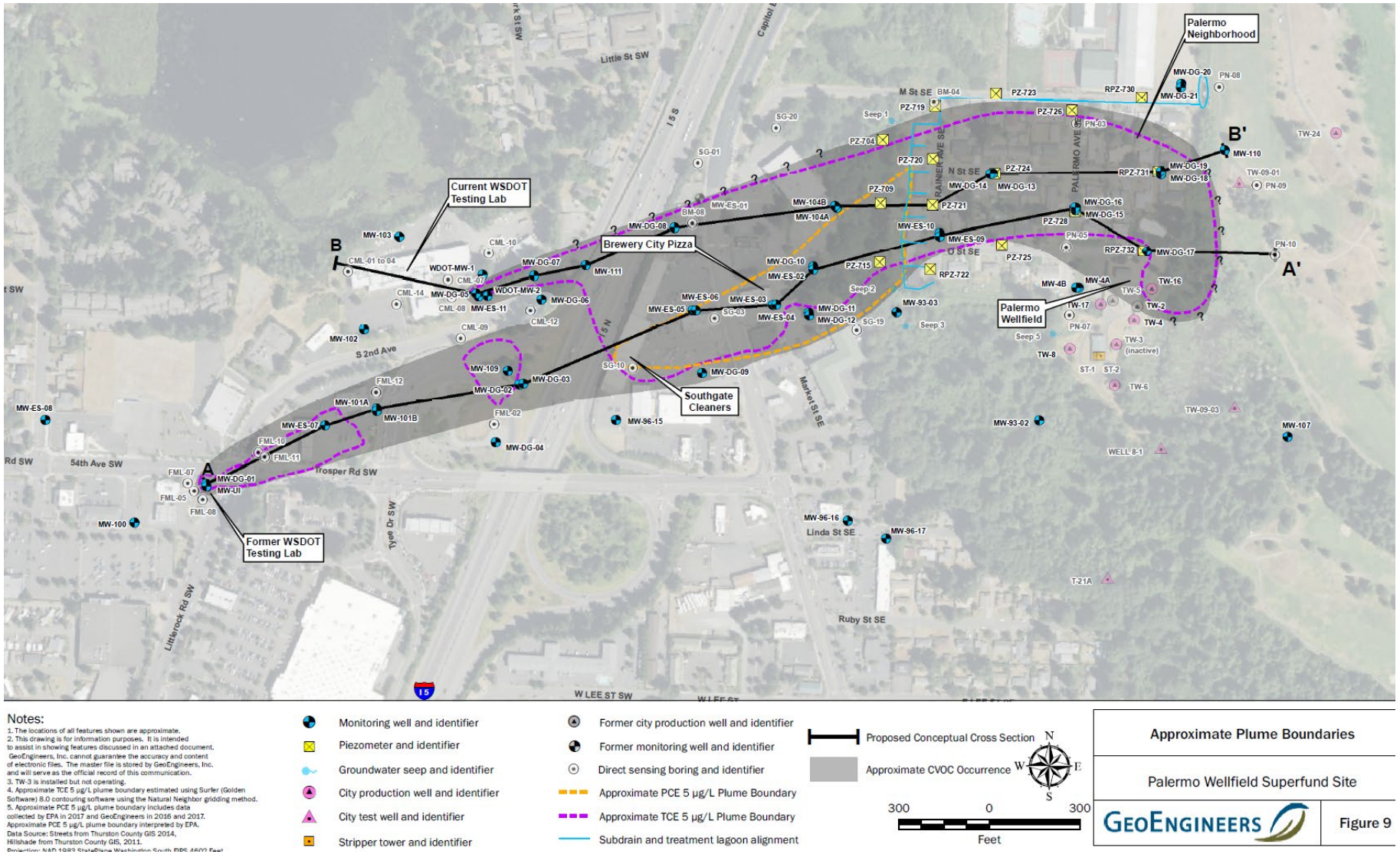
Source: Obtained from the 2013 FYR.

Figure G-2: Site Detail Map



Source: Draft Data Gap Report. Prepared by GeoEngineers, Inc. for Washington State Department of Transportation. January 2018.

Figure G-3: Approximate PCE and TCE Plume Boundaries



Source: Provided by EPA on August 18, 2018.

Figure G-4: Subdrain and Treatment Lagoon Sampling Locations (2016)

Source: 2016 Semi-annual Groundwater Monitoring Report. Prepared by GeoEngineers. Figure 7.

APPENDIX H – ARARs REVIEW

CERCLA Section 121(d)(1) requires that Superfund remedial actions attain "a degree of cleanup of hazardous substance, pollutants, and contaminants released into the environment and of control of further release at a minimum which assures protection of human health and the environment." The remedial action must achieve a level of cleanup that at least attains those requirements that are legally applicable or relevant and appropriate. In performing the FYR for compliance with ARARs, only those ARARs that address the protectiveness of the remedy are reviewed.

Groundwater
According to the 1999 ROD, state MTCA and implementing regulations (WAC 173-340) were identified as applicable for the establishment of cleanup levels for groundwater, surface water, soil and ambient air in Palermo homes. The 1999 ROD identified MCLs established under the State Safe Drinking Water Act and implementing regulations (WAC 246-290) as ARARs for groundwater. The state adopted federal MCLs for volatile organic compounds. The MCLs for PCE and TCE have not changed since the previous Five-Year Review.

Table H-1: Previous and Current ARARs for Groundwater COCs

COC	1999 ROD ARAR (µg/L)[a]	Current ARAR (µg/L)	ARAR Change
PCE	5	5	No change
TCE	5	5	No change

Notes:
a. Based on the SWDA primary MCL. Current SDWA standards can be found at https://www.epa.gov/ground-water-and-drinking-water/table-regulated-drinking-water-contaminants (accessed 3/5/2018).

Surface Water
The1999 ROD remedial goals for surface water were the Washington Clean Water Act and implementing regulations (WAC 173-220-130) and the National Toxics Rule (40 CFR § 131.36) values for the protection of human health protection based on ingestion of water and organisms as determined by the National Toxics Rule to be met within the aeration lagoon. According to the previous FYR, updated MTCA cleanup level concentrations are not applicable to the Site unless the current ROD-selected remedy is determined to be not protective for the surface water exposure pathway. If it is concluded that the current remedy is not protective of human health and/or the environment, then EPA can decide if the remedy (including ARAR revisions) needs to be altered by a decision document.

Soil ARARs
EPA has not established ARARs for soil.